Approaches and Frameworks for Management and Research in Small-scale Fisheries in the Developing World

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Approaches and Frameworks for Management and Research in Small-scale Fisheries in the Developing World

Neil Andrew and Louisa Evans

CGIAR Challenge Program on WATER & FOOD

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Cover photos:
        (front) : Dedi Supriadi Adhuri
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CONTENTS

ABSTRACT

Commonly adopted approaches to managing small-scale fisheries (SSFs) in developing countries do not ensure sustainability. Progress is impeded by a gap between innovative SSF research and slower-moving SSF management. The paper aims to bridge the gap by showing that the three primary bases of SSF management—ecosystem, stakeholders' rights and resilience—are mutually consistent and complementary. It nominates the ecosystem approach as an appropriate starting point because it is established in national and international law and policy. Within this approach, the emerging resilience perspective and associated concepts of adaptive management and institutional learning can move management beyond traditional control and resource-use optimization, which largely ignore the different expectations of stakeholders; the complexity of ecosystem dynamics; and how ecological, social, political and economic subsystems are linked. Integrating a rights-based perspective helps balance the ecological bias of ecosystem-based and resilience approaches. The paper introduces three management implementation frameworks that can lend structure and order to research and management regardless of the management approach chosen. Finally, it outlines possible research approaches to overcome the heretofore limited capacity of fishery research to integrate across ecological, social and economic dimensions and so better serve the management objective of avoiding fishery failure by nurturing and preserving the ecological, social and institutional attributes that enable it to renew and reorganize itself.

INTRODUCTION

There is general agreement that commonly adopted approaches to managing small-scale fisheries (SSFs)[1] in developing countries have been less effective than they need to be to ensure sustainability (Garcia and Grainger, 1997; Mahon, 1997; Cochrane, 2000; Welcomme, 2001; FAO, 2003; Cochrane and Doulman, 2005). Given the importance of SSFs in the social and economic fabric of many least developed countries,[2] it is essential that new management approaches are developed and adopted. This is complicated because SSFs present particular challenges to managers in terms of their diversity and complexity (Berkes *et al.*, 2001; Berkes, 2003; Jentoft, 2006; 2007).

The search for innovation in SSF management is not impeded by a lack of raw material: fishery managers face an overwhelming range of approaches, frameworks, perspectives and methods for analyzing fisheries and 'doing' management. As a way forward, we suggest taking a fresh look at the tools already available and synthesizing them into a coherent scheme that joins management with innovations in research. This document aims to clarify and make explicit the overarching management, implementation and research frameworks and the choices available to managers. As a first step, it is useful to recognize four perspectives on SSF management, as well as what fisheries can contribute to sustainable development. Each perspective has its own emphasis, objectives, constituency and points of entry. From the smallest scale to the largest, these perspectives are:

Inside looking in. This is the classical view. Threats and solutions come from within the domain of the fishery. Managers can ensure sustainability by focusing on the fish and the fishers. Responses include size limits, total allowable catches (TACs), effort restrictions and the like. Classically, fisheries management uses these tools to optimize the fishery's sustainable yield. This perspective on management may be appropriate if key threats and opportunities come from the fishery itself, and if management promotes learning and adaptability to unforeseen shocks.

Inside looking out. This view recognizes that many threats and opportunities come from outside the domain of the fishery, and that in many instances intra-sectoral management alone has little prospect of success. From this perspective, management not only aims to address processes under its direct influence, but also to reduce vulnerability and increase adaptive capacity in the face of threats over which it has no control. 'Resilience' concepts and principles of natural resource management are well-suited to this perspective, but other ways of thinking about the management problem are also appropriate.

Outside looking in. This view mainstreams fisheries management and governance, for it sees fisheries as part of the broader rural (and urban) development problem in which national issues such as governance, rule of law, literacy, use rights and health become appropriate entry points for improved fisheries. Fisheries remain the focus, but solutions are sought from a larger perspective, usually outside the sector.

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[1] The category 'small-scale' is difficult to define precisely and in most respects there is little to be gained from attempts to do so (see Béné *et al.* [2004] and Johnson [2006] for extensive discussions). We follow the definition of Allison and Ellis (2001): "… *those [fisheries] that work from shore or from small boats in coastal and inland waters*." We further note that, for definitional purpose, SSFs are what national governments say they are. Stricter definition of SSFs (e.g. FAO, 2005) is fraught with danger, as any categorization will fail some purpose. Our focus on SSFs does not imply that these fisheries operate in isolation from other sub-sectors or that they can be managed without analyzing the wider context in which they function (see text for further discussion).

[2] This paper is biased towards management and research in least developed countries, where the capacity for management is particularly weak but the importance of SSFs is high. These include, in Africa: Democratic Republic of the Congo, Mali, Malawi, Mozambique, Niger, Senegal, and Zambia; in Asia: Bangladesh and Cambodia; and in the Pacific: Samoa and the Solomon Islands.

Outside looking out. Fisheries *per se* are not important from this perspective, which arises from the perceived failure of investments on a smaller spatial scale and in SSFs themselves. Investments in such things as macroeconomic reform, governance, human rights and national infrastructure are seen as the long-term path to lifting fishery-dependent people out of poverty. Benefits to fisheries will, it is thought, flow from these broader development initiatives. Implicitly, there will be 'winners' who will gain or preserve entitlements and fishery benefits that flow from the generation of taxable revenue. The role of SSFs as open-entry, open-exit social safety nets is downplayed.

In general, the focus of fisheries research and management is shifting along the spectrum from the conventional view to others that consider external disturbance and uncertainty, and wider governance dynamics. Researchers often attribute the failures of conventional fisheries management (target species and resource-oriented management) to an over-emphasis on centralized organization, prescriptive design and the search for optimal use of ecosystems. Such management has largely ignored differences in the expectations of stakeholders[3], the complexity and non-linearity of ecosystem dynamics, and the linkages between ecological, social, political and economic subsystems. Yet these are now widely considered to be necessary considerations for effective and legitimate management. More recently, researchers have also advocated for perspectives that view SSFs within a broader context that includes threats and opportunities from outside the classical intra-sectoral domain of fisheries management (see earlier citations and Andrew *et al.*, 2007 for recent examples). This realization has led donors, governments and non-governmental organizations (NGOs) to place more emphasis on inter-sectoral approaches and on larger-scale responses, such as macroeconomic reforms in which the fishery may be only a small part of a broader solution.

No single class of response at any single scale of organization or time horizon will offer a panacea for the ills facing the management and wider governance of SSFs (Ostrom, 2007; Ostrom *et al.*, 2007). Effective management requires a range of perspectives and the inclusion of different actors in the management process, as well as better engagement in wider governance within society. A range of perspectives may be taken on *management approaches*[4], *implementation frameworks* and *research approaches*; all three phases of the process are related, but separating them helps clarify a complex problem. We concentrate on fisheries from *within* the system; we do not discuss broader cross-sectoral governance issues, though it is important to recognize these different dimensions of SSF management. The governance of fisheries, particularly within the development agendas of countries, is a critical issue and a hot topic for research (see for example Kooiman *et al.*, 2005, Cash *et al.,* 2006; Jentoft, 2007; Mahon *et al.,* 2008).

We begin by describing three primary approaches to fisheries management: ecosystem-based management, rights-based management and management for resilience. All three are well established and, in fact, complementary. Rights-based approaches may, for example, be used to deliver on ecosystem-based objectives. Resilience approaches are much newer innovations that remain largely untested but offer the prospect of integrating many research concepts and methods within an overarching management approach. We then introduce a range of management implementation frameworks that can give structure (i.e., set an order in which things need to be done) to the research and management process. Implementation frameworks are partially independent of the principles and objectives underlying management and research approaches.

Finally, we outline a range of possible research approaches. Both management

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[3]   Stakeholders are people involved in the fishery and its wider context who are affected by decisions concerning the fishery.

[4]   We use the word 'approach' in its common language usage as *'a set of principles and theoretical concepts that define a way of thinking about a problem'* (Webster's New World Dictionary, 1996 available at http://www.merriam-webster.com/).

and research approaches provide the broader context and structure of the fisheries problem. However, the ability of the research community to evolve more rapidly than fisheries law and policy means that research approaches are leading rather than being subservient to management approaches (a case in point is resilience approaches to analyzing fisheries, which are discussed below). As a result of this lag, management's assessment and advisory demands are increasingly out of step with the types of analyses considered useful/ interesting by researchers (Garcia *et al.,* 2008). Here we try to bridge this gap in a way that is appropriate for SSF management in least developed countries.

MANAGEMENT APPROACHES

Almost all countries have laws and policies that articulate the broad objectives of their fisheries sector. The approach taken to managing a fishery will largely be driven by these prevailing policies and laws, but will also be influenced by international conventions, global goals such as the Millennium Development Goals, and international and regional collaborative agreements. Conventionally, most fisheries seek to maximize production over the long term. Most often this refers to fish catch, but it is sometimes phrased in terms of employment or other societal benefits. The fact that these objectives are increasingly being adjusted to accommodate principles of democracy, human rights, decentralization, integration, empowerment, accountability and adaptability, among many others, is causing authorities to rethink their goals.

Approaches to management include: ecosystem-based approaches (notably the ecosystem approach to fisheries [EAF], FAO [2003]), rights-based approaches, integrated approaches (for instance, integrated conservation and development projects [ICDPs] or integrated coastal zone [or catchment] management) and participatory or collaborative approaches (see Varjopuro *et al.*, 2008 for an overview). It is important to note that these approaches are not mutually exclusive, and many share the underlying principles necessary for more sustainable, legitimate and holistic management. For instance, integration and participation are widely incorporated into other perspectives. In the search for practical solutions to SSF management problems, however, it is not sufficient simply to say that fisheries management should become more holistic, participatory or equitable––we must find more effective ways to achieve these things. One entry point is to understand the management implications and practical potential of alternative frames of reference. Below we focus on three related approaches that appear most suited to SSFs in the developing world.

ECOSYSTEM APPROACHES TO FISHERIES MANAGEMENT AND GOVERNANCE

Ecology has been part of fisheries research for a very long time (see Cushing [1975] and Welcomme [1979] as entry points to this early literature). Explicit inclusion of ecological objectives in state-based fisheries management is a more recent phenomenon that is gaining considerable momentum (Hall, 1999; Welcomme, 2001; Degnbol, 2003; Sinclair and Valdermarsson, 2003). Christie and co-authors (2007) provide a useful summary of the evolution and differences in interpreting these management approaches. Some interpretations of ecosystem-based fisheries management remain within the natural sciences tradition, while others seek to balance societal and economic objectives within a sectoral approach (Murawski, 2000; Browman and Stergiou, 2004; 2005; Arkema *et al.,* 2006). Principal among these broader interpretations of an ecosystem approach is the ecosystem approach to fisheries (EAF), discussed more fully below. Broader still is that class of 'ecosystem' approaches that takes a perspective outside the fisheries sector and includes large marine ecosystems, coastal zones or catchments in the system under 'management' (Grumbine, 1994; Cicin-Sain and Knecht, 1998; Sherman and Duda, 1999).

On the global stage, FAO has led the institutional drive to reform fisheries management by promoting and mainstreaming the EAF (e.g., FAO, 1995; 2003; see proceedings from the Reykjavik conference summarized in Sinclair and Valdimarsson, 2003). The EAF is now incorporated into many international conventions, including Agenda 21, the Rio declaration and the Biodiversity treaty (CBD) (www.fao.org). While law and policy often lag a long way behind conceptual advances (Lugten and Andrew, 2008), the EAF and the associated Code of Conduct for Responsible Fisheries (FAO, 1995), because they are championed by the FAO, have considerable

legal and policy status in many jurisdictions and are now enshrined in the national laws of many countries. This legitimacy is important from a practical perspective. As a consequence, the EAF provides the most appropriate overarching approach to SSF management in the developing world. As defined by FAO (2003), the EAF:

"… *strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.*"

The aspirations included in this definition are unarguable and sufficiently broad to be reinterpreted as advances in research and methods demand. Yet, despite the substantial normative power of the EAF (and the Code of Conduct for Responsible Fisheries), there is still much to be done to make it a reality on the ground, particularly in developing countries (Garcia and Cochrane, 2005; Christie *et al.,* 2007; Garcia *et al.,* 2008; De Young *et al.*, 2008). Interpretation and operationalization of the EAF as a practical management approach for SSFs in the developing world remain the central challenge for improved fisheries in these countries. In this respect, the EAF provides a sufficiently broad policy umbrella within which advances in research and management can be tested and refined. However, although the EAF is the most appropriate management approach, we suggest that progress is stymied by, among other things, the absence of an integrative research tradition that is capable of delivering assessment and advice appropriate to its holistic ambitions.

RIGHTS-BASED APPROACHES AND CO-MANAGEMENT

Another class of management approaches, the rights-based approaches, is less explicit about the objective of sustainability and more concerned with the allocation of rights and responsibilities. Rights-based approaches to fisheries management have expanded in focus from *property rights* to *access rights*

to *human rights*. The creation and exercise of legitimate rights offer substantial hope that the sub-sector will achieve sustainable economic development, but simple prescriptions for rights-based management are not sensible in light of the diversity of perspectives in SSFs. Instead, rights-based fisheries management requires a suite of political, legal and policy settings that need to evolve in ways appropriate to the diversity of rights that are often part of the fishery's societal objectives.

Property rights issues still dominate fisheries management. Even within this category, there is a range of perspectives, from debate over private property rights and the roles that the market, the state, the judiciary, and monitoring and evaluation play in defining, distributing and upholding these rights, to understanding the conditions conducive to managing commonly owned resources (including community-based management and co-management). Natural resource management has been heavily influenced by economic models of human behavior and Hardin's (1968) 'tragedy of the commons' metaphor (in Ostrom, 1990; Hilborn *et al.*, 2005). In fisheries, the Gordon-Schaefer diagram depicting a predictable relationship between costs, effort and benefit has dominated management (see Charles, 2001). The relationship between these attributes is controlled in a number of ways, for example, by capping total catches, controlling effort and regulating how fish are caught. Stakeholders continue to debate how best to allocate and regulate property regimes for fisheries (see *Marine Resource Economics* Volume 22[4] [2007] and *Philosophical Transactions of the Royal Society B* Volume 360[1453] [2005]).

In developing countries, the diversity of SSFs makes such management strategies more difficult to implement. Work on common property rights re-established communities as viable stewards of shared resources (Ostrom, 1990; Berkes, 1995; NRC, 2002), while work in cultural and political ecology emphasized the right of communities and local people to be involved in managing themselves and their resources (Berkes *et al.,* 2002; Degnbol *et al.*, 2006). Consequently, there has been a proliferation of participatory

and collaborative management forms (e.g., Wilson *et al.*, 2003; Pomeroy and Rivera-Guieb, 2006).

As they are defined and interpreted in a variety of ways, co-management and community-based management are evolving, conceptually, into relatively complex ideas. Collaborative management, in its simplest form, refers to management processes that include entities (in addition to the state) in decision-making, usually resulting in a partnership between state and resource-users, but also cooperation with other stakeholders and independent organizations (NGOs and research organizations) (Pomeroy and Berkes, 1997; Pomeroy and Rivera-Guieb, 2006). However, co-management and its derivatives also aspire to embody a number of principles of 'good' governance, including democracy, transparency, accountability and sustainability (Wilson *et al.*, 2003). These principles are necessary to ensure that co-management confers the responsibility to share power, knowledge and capacity, as well as to assign tasks. Research continues to examine the conditions suitable for effective communal management of resources (e.g., Agrawal, 2001; 2003), which is proving relatively elusive in practice (Wells and McShane, 2004; Plummer and Armitage, 2007). Property rights and broader access rights continue to be integral to how co-management and community-based management manifest in practice. Several issues complicate the practice of rights-based management:

- Property rights consist of bundles of rights, including *access* (right to enter), *withdrawal* (right to extract), *management* (right to regulate use), *exclusion* (right to deny access) and *alienation* (right to sell, lease or transfer), which can influence how resources are allocated (see Ribot and Peluso, 2003).

- Management consists of a variety of *functions* (policy, service delivery, research and monitoring, institutional design, enforcement, use), *stages* (planning, implementation and evaluation), *levels*

(instructive to informative) and *scales* (spatial, administrative and institutional) at which participation or collaboration can occur (see Sen and Raakjær-Neilson, 1996).

- The notion of a distinct, equitable and consensual 'community' is flawed; thus management that requires a defined set of stakeholders for power-sharing must itself define this 'community'.

- Effective and sustainable collaborative management is likely to require broader political and social transitions (such as decentralization, and effective legislative and judicial institutions) and integrated planning to support it (see Ribot *et al.*, 2006).

Most resource management agreements, conventions and guidelines, including guidelines for putting the EAF into practice (FAO, 2005), stress the importance of collaborative and participatory forms of management. The resilience literature also specifies the need for collaborative management to enable and foster adaptive capacity of social-ecological systems (e.g., Olsson *et al.*, 2004).

More recently, human rights approaches that integrate concerns for access rights, user rights, post-harvest rights and human rights[5] are coming to the fore. Broadly, such approaches espouse principles found in the Millennium Development Goals and the Universal Declaration of Human Rights, including well-being, dignity, non-discrimination and equality, as well as other, more common, principles of good governance such as participation and accountability. Awareness of rights and the capacity to demand rights and hold states accountable are central within this framework. In the fisheries sector, a move towards human rights concerns is evidenced by the mainstreaming of health and education in fisheries research and management and by campaigns such as the right to food (e.g., www.fao.org/righttofood) as a counterweight to the marginalization of local communities from resources as

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[5]   See, for example, www.iucn.org/about/union/commissions/ceesp/index.cfm and www.icfs.net.

a consequence of conservation, tourism, development and large-scale fisheries activities.

MANAGEMENT FOR RESILIENCE

The notion of resilience has risen to prominence in the academic literature on natural resource management in the last decade. Concepts gathered under the 'resilience' banner are characterized by a focus on non-linear change, unpredictability, thresholds, adaptive management, transformation, institutional learning, and vulnerability and adaptation to external drivers (Carpenter *et al.,* 2001; Walker *et al.*, 2002; 2004; Folke, 2006; Folke *et al.*, 2004; Pikitch *et al.*, 2004). As complex systems, SSFs exemplify the dynamic and unpredictable interdependencies of people and nature. Fisherfolk in SSFs are vulnerable to the compounding effects of stresses within fishery systems, as well as to ecological and social forces outside their domain of influence. Building the adaptive capacity of ecosystems and of people is, therefore, central to realizing the conservation, social and economic potential of SSFs in the developing world.

When integrated within the EAF's overarching legal and policy environment, resilience approaches have the potential to profoundly improve SSF management. However, while resilience has become a powerful metaphor for sustainability, advances in theory have yet to be translated into more resilient aquatic ecosystems or better lives for poor fishery-dependent people in developing countries (Carpenter *et al.*, 2001; 2005). The real challenge now is to build bridges between the rapid advances in research and analysis and the real-world legal, policy and organizational constraints of SSF management, particularly in developing country contexts. Poverty and vulnerability, dynamic non-equilibrial ecosystems, and limited capacity and data combine to make this challenge the most important frontier for SSF research. We offer a perspective on the definitional issues that may provide a starting point for 'resilience in practice'.

Definitions of resilience may be traced to Holling's original (1973) definition of resilience in ecological systems:

> *"Resilience is a measure of the ability of systems to absorb changes of state variables, driving variables, and parameters, and still persist."*

This definition is value-neutral, i.e., it is silent about the desirability (or otherwise) of the system configuration, and there are many examples of undesirable but persistent ecosystem configurations. Problems arise when this definition is broadened to include people as part of the system (Brand and Jax, 2007). Definitions of resilient social-ecological systems (SESs) have also been value-neutral (see below), but when it comes to people, 'resilience' is a good thing and much of the message implicit in many definitions is that resilient SESs are desirable. Building on earlier papers, notably Carpenter *et al.* (2001), Walker *et al.* (2004) provide a widely cited definition of the resilience of a social-ecological system:

> *"… the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks …"*

As Brand and Jax (2007) note, simultaneous claims on the term challenge both conceptual clarity and practical relevance. These authors present a useful typology of definitions of resilience and conclude that a clear descriptive definition is useful in ecological science but that a more vague usage is appropriate to foster trans-disciplinary approaches to social-ecological systems (op. cit). This conclusion presents problems in the search for sustainable SSFs, particularly if resilience concepts are to be incorporated into policies, laws and regulations. As noted earlier, management that defines sustainability solely in terms of ecology has largely failed in the context of the developing world. People are an integral part of these ecosystems and their exclusion from analysis and the search for practical solutions will not provide a path to sustainability. This means that we must find an operational form of the term 'social-ecological resilience' (Carpenter *et al.,* 2005) that is appropriate for developing country contexts (see also Vogel *et al.,* 2007). To achieve this goal, we must deal with the

problem of 'value'––who decides what a desirable configuration is, and to whom the benefits flow (Lebel *et al.,* 2006; Nadasdy, 2007).

Given an underlying motivation to reduce poverty through improved fisheries, it is possible to provide a generic definition that is compatible with democratic, participatory forms of management. A resilient SSF in the developing world may be defined as one that:

> *absorbs stress and reorganizes itself following disturbance, while still delivering benefits for poverty reduction.*

Within this overarching definition, there is room for the management constituency to address the political ('value') dimensions of resilience approaches to management and to be specific about beneficiaries. Note, the words 'reorganize itself' are central to any generic definition. The capacity of people and institutions to learn and adapt, and to self-organize and reorganize is critical to building resilience (Folke *et al.,* 2003; Walker *et al.,* 2004; Berkes and Seixas, 2005; Kooiman *et al.,* 2005; Folke, 2006; Mahon *et al.,* 2008 and references within). This individual and institutional capacity to organize and to respond better to surprises is especially important in an adaptive management context (McLain and Lee, 1996). Garaway and Arthur (2004) refine the familiar aphorism 'learning by doing' to 'learning as an objective of doing' to emphasize the centrality of the process. Interestingly, the emphasis placed by these and other authors on learning and empowering participants in a fishery places the conventional usage of the phrase 'capacity building' in sharper relief (see Macfadyen and Huntington [2004] for discussion and review).

Although capacity building is fundamental for making the future less uncertain and for reducing the impact of threats as yet unknown, at the level of the fishery many issues are clear and present. As part of capacity building initiatives, practical resilience management can be pursued by getting on with the business of addressing these threats and opportunities. Within the context of a fishery, the focus then shifts to

defining resilience 'of what' and 'to what' (Carpenter *et al.,* 2001). Answers to these questions are matters of policy choice and stakeholder negotiations that are best addressed as objectives and indicators in the operational management of the fishery, once the participants in the fishery are clear. For resilience-based management to be effective, stakeholders need to be involved in identifying and maintaining system attributes that make up a SSF's identity or in transforming a fishery into a new configuration that will provide more appropriate ecosystem services for social and economic benefits (Cumming *et al.*, 2005).

First, it is necessary to define the boundaries of the fishery system; this provides its identity, which has consequences for governance, the legitimacy of management institutions, the resource harvested, the nature of assessments and the appropriateness of management responses. Critically, it also makes the focal scale for management explicit (Walker *et al.*, 2004). The fishery will be influenced by processes working at both smaller and larger scales, but recognizing the primary scale of focus is a necessary step.

The resilience of an SSF may be threatened by the effects of stressors from within the fishery itself, such as fishing or debt accumulation among fishers, by the cumulative effects of one or several stresses over time or, alternatively, by discrete disturbances such as storms or dam construction (Walker *et al.*, 2002; WCD, 2000; FAO, 2007). Adapting the description of Walker and co-authors (2002) of the generic objectives of resilience management, we can argue that management for a resilient SSF in the developing world should:

> *... prevent the fishery from failing to deliver benefits by nurturing and preserving ecological, social, and institutional attributes that enable it to endure, renew and reorganize itself.*

In this definition, 'benefits' refer to the ecosystem goods and services derived from the fishery. This statement of the management objective, when paired with a definition of the particular fishery being

considered, would seem to provide a useful interpretation of the EAF objective and, therefore, a bridge to reconcile two largely parallel streams of thinking in fisheries. What is missing is a portfolio of case studies that are based on learning from deliberate attempts to implement resilience-based management. There are four related and practical reasons for this gap. First, resilience theory is still evolving and, in the view of many, not yet 'investment-ready'. There are few resilience 'products' available for people responsible for managing fisheries to use. Second, testing resilience-based sustainability in SSFs in developing countries using scales and timeframes appropriate to ecosystems and societies requires large changes in institutions and in the expectations of some of the poorest, most marginalized people in the world. These challenges not only present important ethical dilemmas, but also reduce the probability that failures will be adequately reported and lessons incorporated into other initiatives. Third, the time-scale for building a portfolio of case histories from which to learn is a decadal one. Finally, managers and other decision-makers operate within the statutes and policies of governments. Fisheries law and policy of most developing countries frame 'sustainable exploitation' of fisheries as maximum sustainable yield (MSY), and government ministers and

their agencies are unlikely to step beyond their statutory obligations to test emerging theory. In the short term, management experiments of resilience theory will have to use definitions of resilience and objectives that are reinterpretations of prevailing law and policy rather than radical departures from existing legal frameworks.

To reiterate, ecosystem-based management, rights-based approaches and resilience perspectives are compatible with each other. For instance, management for resilience, within a broad EAF framework, could apply rights-based strategies, including adaptive co-management. Clearly, there are different emphases, which suggests that these different approaches, or combinations of them, may be more or less successful in guiding management of different types of fisheries. A resilience approach seems highly suitable to an '*inside looking out*' perspective, but human rights approaches may be more pertinent to a perspective that sees SSF as a broader governance issue. How these management approaches shape practical management is the responsibility of the management constituency. Implementation frameworks provide a link between these conceptual concerns and choices, and actual practice.
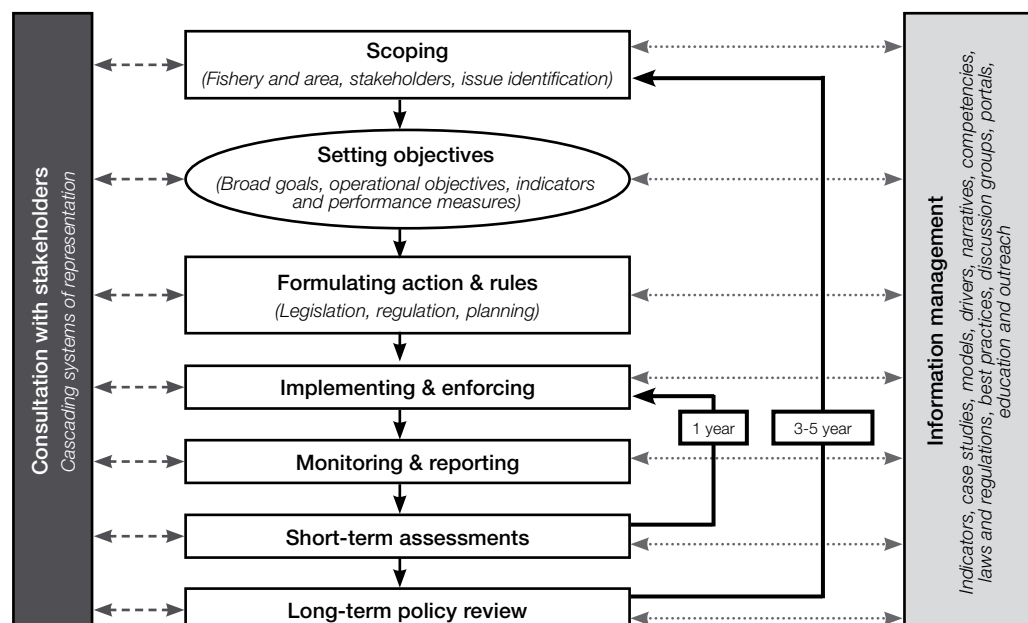
IMPLEMENTATION FRAMEWORKS

Beneath the conceptual approach to managing a fishery, the framework used to implement management provides another level of organization. In particular, it describes relationships among elements of the research and management problem and suggests an order for doing things. Fisheries implementation frameworks may include many elements that, though overlapping, are distinct phases in the process. Common elements include, for example, scoping, assessment, (adaptive) management, and monitoring and evaluation. In a strict sense, an implementation framework is independent of management objectives, but in practice both the management approach and the implementation framework contribute concepts and ways of thinking that guide the choices that are made.

Two recent implementation frameworks, both derived from FAO's (1995) generalized fishery management cycle but with different areas of emphasis, provide a bridge between the EAF's concepts and aspirations and its implementation in developing world SSFs. These are presented below alongside a third implementation framework (Andrew *et al.*, 2007) designed for the diagnosis and management of SSFs in developing country contexts. Together these frameworks can guide the diagnosis and management process from the perspective of any chosen management approach, as informed by international and national policy and legislation characterizing a particular fishery.

In 1995, FAO introduced a general Fishery Policy and Management Cycle with nested levels of activity that scale down from international laws and policies to national governance issues to operational management of a fishery. Each level is connected to those above by a series of feedback loops that allow finer-scale and faster-moving processes to be incorporated within the larger and slower levels above. More recently, FAO has promoted a Management Planning and Implementation Cycle (FAO, 2003) for implementing the EAF, which unpacks the management and implementation components of the original framework. The implementation cycle recognizes a series of steps in the management process, beginning with a scoping phase and running through the conventional steps of setting objectives, making rules, implementing management, and monitoring and assessing outcomes (Figure 1).

Figure 1: The EAF implementation cycle (source: FAO, 2003)

Source: FAO Guidelines

The Management Planning and Implementation Cycle (FAO, 2003) emphasizes assessment and advice, and the feedback loops of management and planning. The basic elements of the framework and their ordering are common to all fisheries, but their emphasis will clearly vary. The framework does not address the political and social process of deciding who is 'in the fishery' and how benefits are allocated, but the cycle does make clear the need to consult with stakeholders at all phases of the cycle. In some fisheries, the managers and different stakeholders are easily identified. In many other cases, they are not, which may lead to less powerful actors being marginalized and more powerful ones wrongly assumed to be central. By extension, access rights and management objectives are frequently unknown or contested, particularly in developing country SSFs.

Garcia *et al.* (2008) adapt the research elements of the EAF implementation cycle to the particular circumstances of SSFs in the developing world (Figure 2). The resulting integrated assessment and advisory framework, again, explicitly restricts itself to the assessment and advisory parts of the cycle. This framework advances the

previous one in that, in addition to the three classical dimensions of fisheries (ecological, social and economic), the authors highlight processes outside the domain of the fishery that need to be considered (see also Andrew *et al.*, 2007). However, the framework does not cover management issues and so is silent on how management is done, what the management objectives are, what access rights are, and who enjoys them.

The Integrated Assessment and Advisory Framework is complete in the sense that it contains all the elements of earlier FAO frameworks but is also idealized. The authors make clear that investment in assessment and management must, in practice, be proportionate to the value of the fishery and appropriate to its complexity (see also Mahon *et al.,* 2008). The capacity of SSFs in developing countries to conduct assessments and to monitor and evaluate outcomes will often be severely limited. As a result, it is unlikely that many SSFs, especially in the least developed countries, will have the resources to fully implement an integrated assessment process. An important part of the scoping exercise for any fishery will be to ensure that the assessment and management process is

Figure 2: Integrated Assessment and Advisory Framework (source: Garcia *et al.*, 2008)
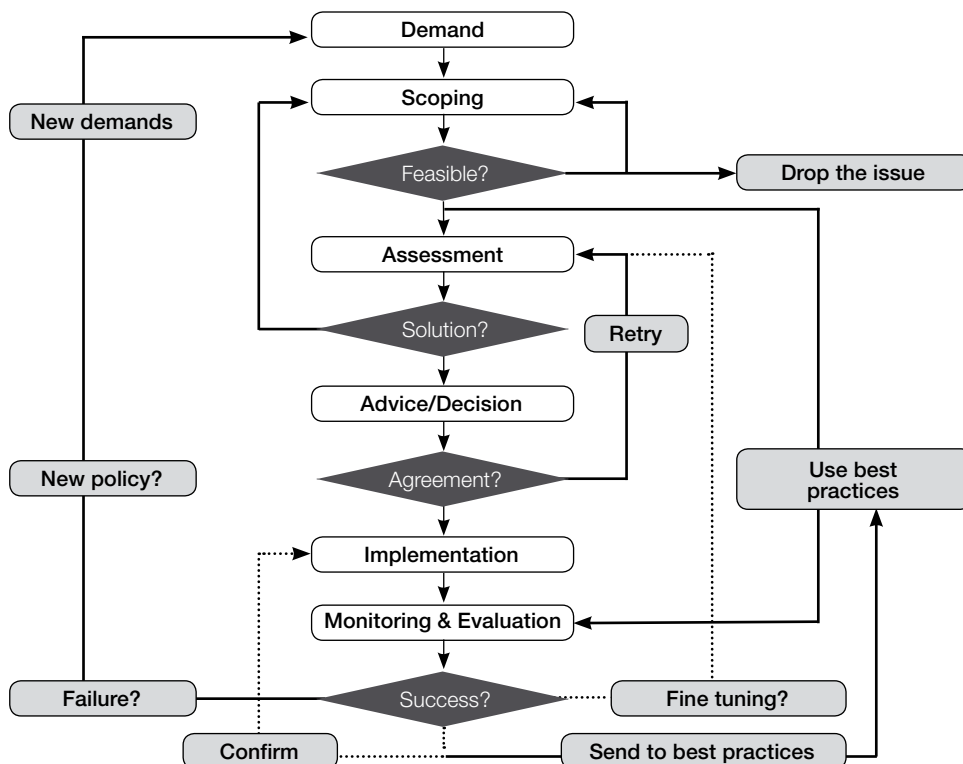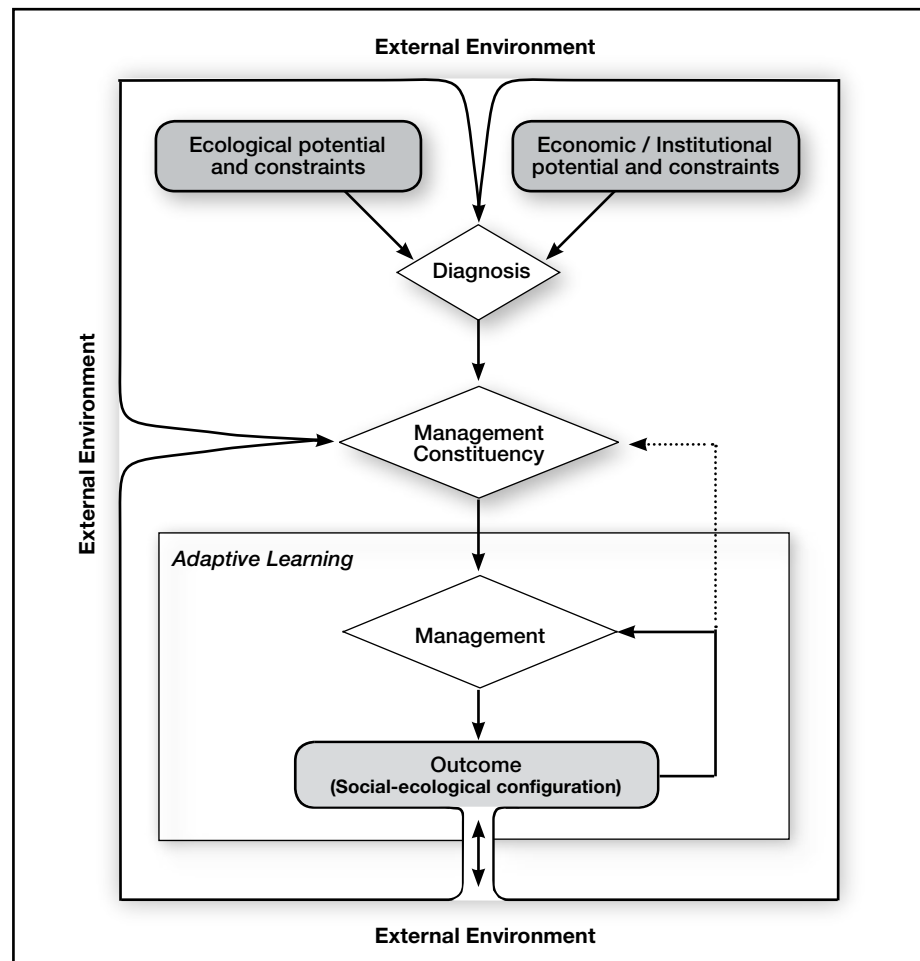
Figure 3: A general framework for diagnosis and management of SSFs in the developing world (Andrew *et al.*, 2007)

commensurate with the ecological, social and economic attributes of the fishery (op. cit.).

Andrew and colleagues (2007) proposed an implementation framework that specifically addresses the challenges presented by SSFs in the least developed countries. They were motivated by the need to have a flexible framework that provides the minimum set of elements in the research and management cycle. It places greater emphasis on: (i) the broader non-sectoral drivers of fisheries management performance and the opportunities and threats they present to people's livelihoods (the *'inside looking out'* perspective), and (ii) the institutions that govern fisheries, particularly the nature and legitimacy of use rights as a central and identifiably separate precursor to effective management. Underpinning this framework is the issue of defining the fishery and, therefore, making a judgment about what

is within the fishery (and directly under the influence of an agreed set of actors) and what is external to it. Management should seek to make the fishery less vulnerable to those external drivers.

This framework attempts to integrate assessment and advice into the management implementation cycle of the fishery. In some respects, it is less prescriptive than EAF implementation or the integrated assessment and advisory frameworks described above, in that it places more emphasis on achieving clarity and building legitimacy of the management process and less on gathering and interpreting data. Following others (e.g., Walters and Hilborn, 1978, Charles, 2001; Arthur and Garaway, 2004; Armitage *et al.*, 2009), Andrew and co-authors (2007) advocate an adaptive management process as the most promising way to learn about the responses of the fishery system to drivers of change.

RESEARCH APPROACHES

There are many different research perspectives that can be used for the diagnosis and advisory portions of the management process. The overarching management approach and the research traditions and capacities of the researchers involved will influence which research perspectives are appropriate and viable. Conventionally, research has been designed to serve the management approach of the day and, therefore, to estimate maximum sustainable yield from target species and monitor the effectiveness of management interventions (see Hilborn and Walters [1992] as the classic text and as an entry point to this literature). In recent years, as limitations in the target resource-oriented management (TROM) approach (an '*inside looking in*' perspective) have become ever more apparent (see earlier references) and approaches such as the EAF have been promoted, other research approaches have come to prominence as researchers seek to provide policy makers and managers with more 'holistic' advice on the sustainability of fisheries. Some of these research approaches––for example, the sustainable livelihoods approach––have been adopted by large development and management organizations, such as the FAO or the World Bank, while others remain within the domain of research.

The choice of research approach has profound implications for the way the fishery is viewed, the questions asked, and the methods or tools employed. Like management approaches, research approaches have different emphases. Some focus primarily on ecological components, while others are founded on rights and entitlements principles or are concerned with institutions and broader governance issues (see Table 1). A variety of research analysis tools and data collection techniques can be used to undertake research guided by any one of these approaches. In fact, many research analysis tools and techniques are common across research frameworks. This paper focuses on overarching management choices and so does not delve into data collection techniques, although many of these are explained in the links in Table 1.

Ecosystem-based management perspectives, including the EAF, have implications for research. Broadly, these perspectives reiterate a multi-dimensional focus on ecosystems, people and livelihoods, and governance and institutions. Many applications of an EAF-based perspective continue to prioritize ecological domains over social or institutional ones.

Also originating from the natural sciences is the resilience approach. Analyses of fishery systems viewed through a resilience lens are emerging (e.g., Berkes and Seixas, 2005; Gelcich *et al.*, 2006; Marschke and Berkes, 2006; McClanahan *et al.*, 2008) and offer important insights into the dynamics of fishery systems on a local scale. Some authors focus primarily on the ecological aspects of resilience management problems, while others address resource use within social-ecological systems and look at both ecological processes and adaptive capacity. For example, Berkes and Seixas (2005) categorize factors that build social-ecological resilience in lagoon systems into four clusters: (i) learning to live with change and uncertainty, (ii) nurturing diversity for reorganization and renewal, (iii) combining different kinds of knowledge, and (iv) creating opportunities for self-organization. However, they find that only certain 'resilience surrogates' are shared among different lagoonal case studies.

Earlier, we suggested that the management objective for SSFs in the developing world might be *to prevent the fishery from failing to deliver benefits by nurturing and preserving ecological, social and institutional attributes that enable it to renew and reorganize itself*. Under this definition, research (in its broad sense and as part of the management process) has two broad purposes, but first it needs to: (i) identify internal and external pressures and drivers that threaten the delivery of benefits, (ii) identify ecological, social and institutional attributes that are critical to the delivery of benefits, and (iii) identify opportunities and conditions for learning and self-organization. Thus the first purpose of management is to reduce vulnerability to those threats and to nurture

Table 1: Web-based reference material on different research approaches. The links refer to background, guidelines and toolkits depending on how established the research frameworks are and whether they cross the research-implementation divide

Research Tradition	Further Reference Material
Ecosystem-based Approaches	**EAF-based research (*sensu* FAO)** http://www.fao.org/docrep/005/Y4470E/y4470e00.HTM **Resilience-based research (*sensu* Resilience Alliance)** www.resalliance.org http://www.resalliance.org/3871.php
Rights-based and Entitlements Approaches	**Development network (Eldis) including information on SLA (*sensu* FAO / DFID)** http://www.eldis.org/ http://www.eldis.org/go/topics/dossiers/livelihoods-connect/what-are-livelihoods-approaches/training-and-learning-materials **Chronic Poverty Research Centre Toolbox for SLA (DFID)** http://www.chronicpoverty.org/toolbox/toolboxcontents.php **NZAid analytical tools including SLA and rights-based approaches** http://nzaidtools.nzaid.govt.nz/tools/analytical-tools http://nzaidtools.nzaid.govt.nz/sustainable-livelihoods-approach **Vulnerability assessment** www.vulnerabilitynet.org **Well-being approach (*sensu* Bath University)** http://www.bath.ac.uk/econ-dev/wellbeing/research/research.htm
Wealth-based Approaches	**Poverty mapping, profiling, and wealth ranking etc (*sensu* World Bank)** http://siteresources.worldbank.org/INTPOVERTY/Resources/335642-1098192957114/op1_pa_guidance.pdf
Institutional Assessment and Governance Approaches	**Institutional Analysis and Development** http://www.indiana.edu/~workshop/ http://dlc.dlib.indiana.edu/view/subjects **PNAS special feature, 2007:** http://www.pnas.org/content/by/year **Governance framework** http://www.fishgovnet.org/ http://www.fishgovnet.org/downloads/documents/bavinck_interactive.pdf

institutions in order to build adaptive capacity and learning. The second broad purpose of research is to monitor and evaluate the efficacy of management responses in pursuit of objectives.

The Resilience Alliance has published beta versions of generic workbooks for assessment and management of resilience (see http://www.resalliance.org/3871.php), but a 'how-to' manual for resilience analysis for SSFs has yet to be written. The workbooks suggest questions organized around the core issues that underlie resilience thinking, such as:

- Defining and understanding the system by considering past, present and future states. Subsets of this broad issue include questions such as resilience 'of what' and 'to what', and who the people involved are, as well as institutional constraints and management opportunities.

- Developing conceptual models of current and alternative states of the system, including definition of the system under management (the focal scale), and possibly even developing alternative future scenarios to guide management decisions. A particularly challenging subset of questions focuses on recognizing thresholds of change.

- Developing preliminary management responses to maintain desirable system configurations or to transform undesirable ones.

It is unlikely that the full set of analyses canvassed in the Resilience Alliance workbooks will be possible for most SSFs in least developed countries. As a consequence, the adaptive management phase of the management cycles assumes even greater importance, given that learning is much more likely to come from managing and evaluating. We also note that, as with the

FAO management cycle described above, the workbooks do not emphasize who the participants, managers and stakeholders are, and which institutions confer legitimacy. These questions are central for SSFs in the developing world, where the identity of these people and organizations is often contested.

From another angle, the 'capacities, capabilities and entitlements' research approaches (Bebbington, 1999) prioritize people-centered, rather than resource- or economics-based, perspectives for both social development and natural resource management. They also emphasize human agency (as capacity) in contrast to broader structural constraints. These approaches have raised awareness of the multiple dimensions of poverty that exist, beyond the lack of access to financial capital. Examples include the sustainable livelihoods approach (SLA), vulnerability assessments and well-being approaches (see Table 1). An SLA aims to understand the role and diversity of individual and household livelihoods in the context of factors that make them vulnerable. For example, Allison and Ellis (2001) used an SLA to understand the strategies of fisherfolk facing resource fluctuations. They showed that use rights can restrict the flexibility of fishers to migrate and to move in and out of the fishery in response to variability; thus, contrary to popular assumptions, use rights can undermine both livelihood strategies and ecological sustainability. A strength of the SLA lies in the micro-level analysis of the dimensions of poverty, which is highly pertinent for SSFs in developing country contexts. However, in some SSFs, it may be more relevant to examine the meso- and macro-level aspects of poverty; in such cases, vulnerability and poverty assessments provide a broader research focus. Such approaches have sometimes served as useful frameworks for implementation as well as for thinking about a problem. For example, the SLA's emphasis on the many cross-sectoral dimensions of poverty and vulnerability has made it useful in designing poverty-reduction projects (e.g., Ellis, 2000; Allison and Ellis, 2001; Allison and Horemans, 2006).

Another subset of research approaches within the development and environmental sciences focuses more on the institutional conditions needed for successful management and wider governance. While entitlements and rights-based approaches are primarily concerned with poverty reduction and social justice, institutional frameworks aim to develop a theory of effective collective action. Institutional approaches highlight a diverse set of multidisciplinary variables that go beyond institutions *per se* to consider a range of contextual factors. Examples of institutional assessment frameworks include the institutional analysis and development (IAD) framework, the framework for analyzing social-ecological systems (Ostrom, 2007; *Proceedings of the National Academy of Sciences* Volume 104: 2007) and the interactive governance approach, which was developed specifically for fisheries (Bavinck *et al.*, 2005; Kooiman *et al.*, 2005). These frameworks have been used to address a variety of research questions in natural resource management and are appropriate for understanding context, the subtle conditions necessary for cooperation and collaboration between stakeholders, and the potential of different institutions to successfully coordinate management and resource use.

CONCLUSIONS

The gap between policy, legislation and the practical aspects of fisheries management, and the thinking of the academic research community is a persistent barrier to integration and progress in SSF management and governance. In one respect, the simplicity and apparent explanatory power of conventional models and metrics (e.g., MSY) mean they are firmly engrained in management practice. On the other hand, the relative lack of investment in operationalizing new concepts has resulted in a divergence between fisheries practice and science.

In an attempt to bridge this gap, we have focused on themes of ecosystem, rights and resilience to show some consistency between overarching management approaches and the research perspectives available for the assessment and advisory process. Each of these approaches provides significant and unique contributions to fisheries management. More importantly, these approaches and frameworks can work together. We argue that the EAF provides the most appropriate over-arching approach to management because it is established in national and international law and policy. Within the EAF's broad objective, a resilience perspective and associated concepts of adaptive management and institutional learning can provide a way of moving beyond management forms that are based on control and optimization. As an ideal, a democratic and participatory form of management can also address the political issues of what is desirable in terms of system configuration, what are the (internal and external) threats and opportunities for SSFs, and who benefits from a particular system regime. Integrating appropriate rights-based approaches as principles (e.g., equality and accountability) and practical management strategies (e.g., property rights, co-management processes) can add to a comprehensive management and research approach to SSFs. In particular, rights-based perspectives can help balance the ecological––and potentially conservation-oriented––bias of ecosystem-based and resilience approaches. This is crucial for SSFs in developing country contexts. The

conceptualization of resilience outlined in this paper is consistent with human rights-based thinking.

Second, alternative management and research approaches, and the multiple principles that underpin them, are often considered somewhat restrictive in developing country contexts. In particular, managing for resilience through adaptive management, monitoring and learning processes is seen as capacity- and resource-intense. We think this is a misconception. The EAF, resilience, and rights-based management and research approaches are all underpinned by principles of participation, appreciation for multiple perspectives and knowledge, and collaborative learning and decision-making. These approaches are expected to enable more flexible management processes, in contrast to control by external experts, and investment in management can be scaled to be appropriate to the fishery.

The greatest impediment to progress has probably been the fact that, within the conventional fisheries research tradition, there has been little capacity to integrate across the many dimensions (ecological, social and economic) of a fishery system (Charles, 2001; Garcia and Charles, 2007). Further, its intra-sectoral focus has meant that external threats and opportunities have not been well addressed in assessment and policy advice. A result of this has been that management has performed poorly in SSFs in the world's least developed countries. Innovation in research occurs much faster than innovation in management. Combining the broad management approach of the EAF and the innovation in the resilience approach to analyzing fishery systems presents an important opportunity in fisheries management in the developing world. If management is able to prevent the fishery from failing to deliver benefits that reduce poverty by nurturing and preserving ecological, social and institutional attributes that enable it to renew and reorganize itself, then these approaches to SSF are more likely to succeed than conventional approaches. Nevertheless, there remains

considerable work to be done to crystallize appealing theory into well-grounded and tested approaches and frameworks for analysis and policy advice. Building such a portfolio of practice in alternative SSF management is the principal challenge to reconciling EAF, resilience and rights-based SSF approaches.

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Commonly adopted approaches to managing small-scale fisheries (SSFs) in developing countries do not ensure sustainability. Progress is impeded by a gap between innovative SSF research and slower-moving SSF management. The paper aims to bridge the gap by showing that the three primary bases of SSF management—ecosystem, stakeholders' rights and resilience—are mutually consistent and complementary. It nominates the ecosystem approach as an appropriate starting point because it is established in national and international law and policy. Within this approach, the emerging resilience perspective and associated concepts of adaptive management and institutional learning can move management beyond traditional control and resource-use optimization. Integrating a rights-based perspective helps balance the ecological bias of ecosystem-based and resilience approaches. Finally, the paper outlines possible research approaches to better serve the management objective of avoiding fishery failure by nurturing and preserving the ecological, social and institutional attributes that enable it to renew and reorganize itself.

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