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ECONOMIC, ENVIRONMENTAL, AND SOCIAL EVALUATION OF AFRICA'S SMALL-SCALE FISHERIES

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ENVIRONMENTAL, ECONOMIC, AND SOCIAL EVALUATION OF AFRICA'S SMALL-SCALE FISHERIES

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ACKNOWLEDGMENTS

This report is the culmination of a cross-African countries analytical and empirical study commissioned by the World Bank, which set out to improve the understanding of the characteristics and environmental, economic, and social performances of small-scale fisheries in Africa. It applies a common evaluation tool, called Fishery Performance Indicators (FPIs), which evaluates the ecological, social, and economic performances of a particular fishery (see details in Anderson et al., forthcoming).

Jingjie Chu (Natural Resource Economist, Environment and Natural Resources Global Practice, World Bank) and Jennifer Meredith (Graduate Student, University of Washington) are the primary authors of the report. Jingjie Chu is the study's overall task team leader. She produced the FPIs survey design, provided overall guidance to the study team, and helped compile and edit the final synthesis report. Jennifer Meredith compiled all the case studies, conducted cross-country analysis, and drafted the synthesis report. Tim Bostock (former Senior Fishery Specialist, Environment and Natural Resources Global Practice, World Bank) helped develop the terms of reference, identify consultants, coordinate the case studies and workshop, and contribute to the introduction. Steve Cunningham (Institut du Développement Durable et des Ressources Aquatiques [IDDRA]) developed the case study template and helped coordinate the case studies, along with drafting the synthesis report.

The team wishes to thank and acknowledge the invaluable contribution of the following case study authors: Robert Arthur (Marine Resources Assessment Group [MRAG], with Patrick Sayon, Glasgow Togba, and Alvin Jueseah) for Liberia; Max Schmid (Environmental Justice Foundation [EJF]) for Sierra Leone; Wisdom Akpalu (United Nations University) for Ghana; Lorna Slade (Mwambao Coastal Community Network) and Fred Nelson (Maliasili Initiatives) for Kenya; Friday Njaya for Malawi; and Lamine MBaye for Senegal. Each of these reports can function as a stand-alone publication. However, with time and budget constraints, they have been combined.

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ABBREVIATIONS AND ACRONYMS

BVC	Beach Village Committee
CMA	Community Management Association
EJF	Environmental Justice Foundation
FAO	Food and Agriculture Organization (of the United Nations)
FPI	Fisheries Performance Indicator
MPA	Marine Protected Area
MRAG	Marine Resources Assessment Group
NEPAD	New Partnership for Africa's Development
RBM	Rights-Based Management
SSFs	Small-Scale Fisheries
TURF	Territorial Use Rights in Fisheries

EXECUTIVE SUMMARY

Small-scale fisheries (SSFs) in developing countries are extremely important for local communities, as they are the main source of food, livelihood, and income. Small-scale fishing communities are vulnerable to overexploitation of fish stocks owing to insecure access and use rights to the fishery resources and limited alternative livelihood. This is most often the group in extreme poverty and also one that is frequently overlooked. To cast some light on the status of SSFs in Africa and their relationship with the existing institutional and governance arrangements, the World Bank (former Africa Region Environment and Natural Resources Management unit together with PROFISH) and the New Partnership for Africa Development (NEPAD) commissioned a series of case studies across Africa in 2013. The fisheries case studies range from inland to marine, single to multispecies, East to West African, and from artisanal to semi-industrial fisheries.

A template was developed to provide structure and guidance for these case studies. Each case study involved the following elements: (a) characterization of SSFs (at both the national and case-study levels); (b) legal and institutional framework for case-study countries and communities; and (c) social, economic, and environmental performance of case-study fisheries. This synthesis report focuses on element (c) by using the standard Fishery Performance Indicators (FPIs) to do the comparison analysis.

METHODOLOGY

The FPIs are a new set of evaluation tools to measure the triple bottom line sustainability of a particular fishery recognizing that the sustainability of fish stocks, fishing industries, and fishing communities are interrelated and that none can provide benefits without the others. The FPIs consist of two categories: output indicators that measure the wealth generation status of a fishery and input factors that enable or contribute to the success or failure of fishery wealth generation. All of the indicators are coded on a five-point scale, with the bins chosen to reflect the quintiles of performance on the global metric. FPIs are designed to be easy to collect. They are quantifiable, understandable, accurate, and feasible.

This evaluation tool strives to balance accuracy with rapid assessment as no primary data collection is required, which makes them very cost effective, particularly for data-poor countries. It also has the potential to change how fishery managers, stakeholders, and aid agencies measure progress, as it focuses on three dimensions at the same time. So far, it has been tested in more than 50 fisheries by researchers all over the world.

Another feature of this evaluation tool is the quality score for each measure, which indicates how confident the scorer is regarding the accuracy of the chosen bin. Despite the ease of application, the quality of the data is high, yielding a good snapshot of the biological, economic, and community conditions associated with the corresponding fishery.

This report uses the quantitative results from the FPIs to explore commonalities and differences among and between the nine African fisheries in six countries (Ghana, Kenya, Liberia, Malawi, Senegal, and Sierra Leone) and to infer their relative strengths and weaknesses. Additionally, the existing FPI dataset (which includes 50 other fisheries) allows the analysis to be expanded to include a comparison with African fisheries in general and with fisheries in developed and developing countries around the globe.

KEY FINDINGS

Overall, there are large performance gaps in the recent African SSFs in terms of the output performance. These fisheries have unhealthy fish stock, high-risk volatility, weak market performance, and postharvest performance. Moreover, they also lag behind in harvest performance, harvest asset performance, and postharvest asset performance. They appear to slightly outperform the rest of the database in wealth accumulating to processing workers. The following is a summary of these fisheries' performance with regard to the triple bottom line.

Ecologically, the environmental performance of these case-study fisheries is very low relative to the rest of the database, especially relative to fisheries with effective harvest rights. The only exceptions to the norm of abysmal ecological indicators are the Liberian fisheries. This can be attributed to the success of a recently implemented trawler spotter program that has been effective at keeping illegal industrial trawlers out of inshore zones.

Economically, as we would expect, the performance of these fisheries is poor. In the absence of infrastructure, these fisheries lack the capacity for value-added processing and are forced to smoke, dry, or ferment the harvest to prevent spoilage. The case-study fisheries have a low percentage of landings going to fresh market or international market, very few processing facilities that are certified to export, and a low proportion of harvest undergoing product enhancement. This contributes to low postharvest wholesale prices relative to similar products and inhibits the fisheries from extracting maximum economic rents from their value chains. The only exception is the Kenyan octopus fishery in which processors from the coastal hub of Mombasa play a large role in targeting export markets. The postharvest sector of this octopus fishery performs particularly well with regard to ex-vessel to wholesale margins and the facilitation of international trade.

The case-study fisheries experience more annual fluctuation in total revenue, landings, and prices than the average African fisheries or FPI database fisheries. **The instability fostered by such fluctuations inhibits harvest sector investments and efficient exploitation of the resources in those SSFs.**

Socially, the community performance of the recent African SSFs is much closer to the average for all FPI databases. This can be attributed to community measures that are scored relative to local alternatives and not entirely on a global scale. Additionally, the recent case studies all concerned fisheries in which the majority of harvesting and processing is undertaken by locals, whereas many high-revenue fisheries attract participants from outside the community who may extract resource wealth without contributing to local economies.

Another community issue that the FPI scores allow us to analyze is that of equity within the fishery. When the scores for income, education access, health care access, local residency, and social standing are averaged across the four occupations in the fishery (boat owners/captains, harvesting crew, processing owners/managers, and

processing workers), a picture of the wealth distribution within the fishery emerges. **It appears that fisheries with strong tenure systems tend to see more wealth accumulating to the harvest and processing capital owners but that wealth does not seem to come at the expense of the harvest crew and processing workers.** It is interesting that the average wealth distribution in the recent African SSFs is very close to being equal. The outlier is the Kenya octopus fishery that relies on export processing and shows clear accumulation of wealth to boat captains and processing owners.

When looking at input factors, the case-study fisheries consistently score lower than the average FPI database in each input dimension except for the comanagement dimensions of collective action, participation, community, and gender. Another dimension in which the recent case studies score relatively high is that of markets and market institutions, probably because these fisheries tend to have competitive landing pricing systems with many buyers and very few official tariff/nontariff barriers to international trade. There are large performance gaps in the recent African SSFs in terms of macroindicators such as general environmental performance, governance, and economic conditions. In addition, they also lag behind in fishing access rights, harvest rights, data management, and infrastructure.

The role of women was very similar across the case-study fisheries. Women are dominant in the postharvest sector (on average, from 60 to 80 percent of processors were female). The Ghanaian fishery demonstrated a high degree of female participation in businesses owing to the traditional role of the "Fish Mommy/Monger/Queen," who is the local authority on postharvest operations. This "Fish Queen" exercises a high degree of control over the local market by setting the prevailing price at the beginning of each trading day after examining the first three landings and making a judgment on the price that day. **This degree of influence by women in these African SSFs is far greater than that of most developed country fisheries, where both harvest and postharvest sectors tend to be dominated by men.**

All of the case-study fisheries have very weak data management. Small samples with lots of missing data are collected irregularly, which prohibits proper management. Even when data on landings exist, they are used only inconsistently or irregularly. Despite the proliferation of cellular phones, price and quantity information are often inaccurate, delayed, or available to only a few and very little historical data are recorded.

All of the case-study fisheries have limited basic infrastructure. Many of the recent fisheries are in remote locations where ocean/air shipping from landing site to port of export is unavailable or available only occasionally. The roads are most likely to be poorly maintained gravel or paved two-lane roads at best. Technology adoption is limited to cellular phones and there are no sophisticated fish finders or production technology as is the norm in other fisheries. Where electricity is available, supply chains often lose produce because of irregular fuel supply or unreliable generators. Importantly, ice is available but not in sufficient quantities to meet the demand. It is often reused and is not applied to the entire catch throughout the supply chain, which explains why product improvement is often so low.

All of the case-study fisheries can be classified as regulated open access. There is a local authority who must be consulted before accessing the resource but these authorities have chosen not to limit the number of harvesters, which undermines their ability to exercise control over the sustainability of the resource. There was some variation across the recent case studies owing to differences in the exclusivity (some had more intrusion from industrial trawlers or aquarium fishers); in the flexibility (some were subject to very strict gear/area restrictions); and in the security/durability (certain fisheries had a very strong tradition of de facto open access whereas others were subject to arbitrary federal government decisions). Access rights in Malawi were the strongest because there was a higher degree of exclusivity than elsewhere with fewer incursions from outsiders owing to the remote nature of the lake fishery. Ghana also scored relatively high because of the strong tradition of de facto rights that influenced participants' perceptions of security and durability. Liberia scored slightly higher because of the recent trawler spotter efforts, but they still suffer from low security scores because of the unstable nature of the national government.

The recent African SSF samples have shown stronger leadership and social cohesion. In the case of Ghana, the scores are exceptionally high because they have a century-old tradition of leadership from the Chief Fisherman and Fish Mommy, who govern the harvest and postharvest sectors, respectively, with absolute authority. Within the region, Ghanaians are renowned as expert fishermen and their heritage of shared cultural norms and centuries of fishing experience is demonstrated in their high social cohesion scores.

RECOMMENDATIONS

Preliminary analysis leads to the following recommendations:

- **The FPIs are a useful tool for data-poor fisheries because they provide cost-effective yet holistic estimates of the existing state of fisheries management by efficiently relying on the input of local experts.** Fisheries can be scored using the FPI framework in only one to two weeks, yet the information gathered provides insight into economic and social variables that are traditionally ignored in fisheries management benchmarking. The exercise demonstrates that even in such data-poor fisheries, we can still obtain adequate quantitative scores that facilitate comparison and inference by collecting the FPI scores.
- **Ecological variables alone are not suitable proxies for economic welfare or community well-being.** The variability of fishery rankings when done according to either ecology, economics, or community FPI output scores lead us to conclude that economic and social variables cannot be omitted and replaced exclusively with stock assessments.
- **Access and harvest rights appear to be positively correlated with ecological and economic sustainability, whereas other inputs such as leadership and social cohesion do not contribute to the same increase in scores.** Although some fisheries management experts have predicted that the implementation of rights-based management (RBM) will lead to higher levels of inequity within the fishery, the lack of declining community scores with more exclusive rights arrangements leads us to conclude that this is not true.
- **FPI data should be collected regularly to track progress and impact of interventions.** This report demonstrates that collecting data on the FPIs provides decision makers with valuable baseline data on the ecological, social, and economic performance of their fishery and also allows for informative comparisons across fisheries. The FPIs have the power to test hypotheses from a range of social science models and are constructed to measure enabling factors alongside a multitude of outcomes. Even in the short term, cross-sectional analysis permits policy makers to draw useful conclusions about the relative importance of factors, but a more rigorous test of hypotheses from a range of social science models will only be possible if FPI data are collected in the same fisheries over time. In the long term, repeated collection of FPI data within a given project is an important component of evaluating and monitoring the Bank's investments in fisheries management. Data should be collected within these case-study fisheries at regular intervals so that managers can map the intermediate steps that accompany policy changes.
- **Comparison of the recent case studies leads to the recognition of two key outliers: ecological outcomes in Liberia and economic outcomes in Kenyan octopus.** Trawler spotter programs such as the one operating in Liberia can be effective at generating short-term ecological gains and we recommend that such efforts be scaled up and accompanied by efforts to simultaneously limit the activity of smaller vessels so that stock recovery is not temporary. The Kenyan octopus fishery suggests that a postharvest sector focused on value addition and export is capable of generating large economic gains for boat owners and processing managers that do not appear to come at the expense of the local community.
- **Improvements in infrastructure should be coupled with strengthening tenure to enhance the efficiency of the value chain.** In the absence of effective federal or local management, processors have a vested interest in ensuring the sustainability of the stock, especially if they have sunk capital investments in the form of facilities and improved technology.

CHAPTER ONE
INTRODUCTION

Many of the world's fishery resources—both in marine and inland waters—are in a precarious state despite the fact that the international fish trade broke records of more than US$136 billion in 2014 (FAO 2014). Fisheries generate livelihoods for more than 100 million people and represent a vital source of nutrition (FAO 2014); however, it is estimated that around 5.8 million fisherman exist in poverty, often in rural coastal communities in Africa and Asia (FAO 2014). Overfishing and overcapacity characterize numerous fisheries around the world, resulting in lower potential for fisheries to contribute to sustainable economic, social, and environmental development in the way the sector could.

Small-scale fisheries are particularly vulnerable because of insecure access and use rights with respect to the resources upon which communities depend for income, livelihoods, and food. In many developing countries, legitimizing and bolstering traditional rights over SSFs could be part of the formula for improving the governance of fisheries (World Bank and FAO 2009). Customary practices for resource allocation and benefit sharing within coastal communities engaged in fishing have been frequently undermined by weak access rights leading to destructive competition with fellow fisherman and with other higher-profile economic sector developments such as tourism, aquaculture, energy, mining, industry, and infrastructure.

Improving governance of tenure, taking these aspects and underlying causes into consideration, is therefore a matter of urgency for fisheries to continue providing contributions to growth, nutrition, and livelihoods in developing countries. To address this issue, during 2013 the World Bank (formerly Africa Region Environment and Natural Resource Management unit together with PROFISH) and the NEPAD commissioned a series of case studies throughout Africa. The studies set out to identify the relationship between the performance of SSF and the existing institutional and governance arrangements that underpin these.

In support of this objective, the Fisheries Performance Indicators were used to provide a quantitative perspective of fisheries performance at all of the case study locations. The **FPIs are a rapid assessment instrument for measuring the level of success that the management systems are having in generating benefits for the environment, community, and economy** (Chu, Anderson, and Anderson 2012). The guiding principle is that a successful fishery management system is one that is ecologically sustainable and socially acceptable, and generates sustainable resource rents or profits. The FPIs fall into two categories: (a) *output* indicators that identify and measure key factors that reflect success or failure in the attainment of the "triple bottom line" of environmental, social, and economic sustainability, including 3 components, 11 dimensions, and 68 indicators (see appendix A for details) and (b) *input* factors that enable or contribute to the process of meeting the "triple bottom line," including 5 components, 15 dimensions, and 54 indicators (see appendix B for details). All of the indicators are coded on a five-point scale, with the bins chosen to reflect the quintiles of performance on the global metric.

For the output indicators, there are two ways to group them. One is the triple bottom line way (social, economic, and ecological sustainability) and one is based on the sector (stock performance, harvest sector performance, and postharvest sector performance). The latter is useful for describing distributional outcomes and for potential investors in different segments of fishery (Anderson et al., forthcoming). The braiding shows how each individual metric can be regrouped into different dimensions and indicators that emphasize different aspects of sustainability (see appendix A).

FPIs are designed to be easy to collect and do not require detailed data. They are quantifiable, understandable, accurate, and feasible. A local expert who understands the fishery well is the key. A detailed manual to explain each indicator and a user-friendly MS Excel spreadsheet have been developed that local experts can fill out easily with summarized results and graphs. FPI scores are assigned after consultation and in-person interviews with key stakeholders, managing officials, and important industry leaders. It strives to balance accuracy with rapid assessment. As **no primary data collection is required, FPIs are a very cost-effective tool with the potential to change how fishery managers, stakeholders, and aid agencies measure progress.** The tool has been tested in more than 50 fisheries by researchers all over the world.

Each measure is also given a quality score to indicate how confident the scorer is regarding the accuracy of the chosen bin. Although individual metrics may be imprecise, using multiple metrics for each performance dimension leads to an accurate impression of what is and is not working. In this manner, the FPIs are robust and can be employed in data-poor fisheries and sectors. Analysis across the dataset reveals that despite the ease of application, the quality of the data is high, yielding a good snapshot of the biological, economic, and community conditions associated with the corresponding fishery.

The FPIs are designed not only as a tool for identifying fisheries that are underperforming in meeting the triple bottom line but also as a framework for pinpointing what policies and interventions are likely to have the greatest impact and for research that supports evidence-based policy making. By analyzing relationships among the wealth creation and input measures, the FPI dataset can be used to understand the causes, correlations, and paths toward successful industry development that can arise from investment in, and changes to, fishery policy and practice. It is worth mentioning that sophisticated econometric analysis regarding the output and input relationship has not been included in this report because of the limited sample. Other analysis methods such as Data Development Analysis and Stochastic Frontier Analysis can be explored when more samples have been collected.

The goal of this report is to demonstrate that collecting data on the FPIs provides decision makers with valuable baseline data on the ecological, social, and economic performance of their fishery and also allows for informative comparisons across fisheries. In the long term, repeated collection of FPI data within a given project is an important component of evaluating and monitoring the investments in fisheries management. Even in the short term, cross-sectional

analysis permits policy makers to draw useful conclusions about the relative importance of factors such as property rights, infrastructure, enforcement, and other management inputs.

The focus of this report is to explore commonalities and differences between the nine African SSFs surveyed in 2013 and then to expand the analysis (using the entire FPI database) to include a comparison with African fisheries in general and with fisheries in developed and developing countries around the globe. The final sets of FPI scores examined in this report are from fisheries located in six different countries: Ghana, Kenya, Liberia, Malawi, Senegal, and Sierra Leone. In the case of Kenya, Liberia, and Sierra Leone, the case-study data were broken into two different sets of FPI scores for a total of nine fisheries. This synthesis report uses the quantitative data from the FPIs to infer the relative strengths and weaknesses for each of the nine fisheries. In addition, a summary of the management structure in each fishery is found in appendix C. For more detailed qualitative insights into the nature of rights in Liberia and Sierra Leone, the reader should refer to the individual case-study reports for these countries, which will be published separately. The set of case-study fisheries and their authors are the following:

- Ghana (Axim)—Wisdom Akpalu
- Kenya (Shimoni: Artisanal and Octopus)—Lorna Slade
- Liberia (Robertsport and Marshall: Artisanal and Semi-Industrial)—Robert Arthur/MRAG
- Malawi (Lake Chiuta)—Friday Njaya
- Senegal (Ngaparou)—Lamine MBaye
- Sierra Leone (Sherbro Estuary and Tombo)—Max Schmid

Too often, the success of a fishery is narrowly defined as ecological sustainability, but the social and economic dimensions are overlooked. Table 1.1 demonstrates that if only ecological sustainability is evaluated, it will generate different results from those measured based on the triple bottom line evaluation tool. For example, the first column in table 1.1 shows how the 48 fisheries currently in the FPI database are ranked when ecology alone is considered. If instead, all of the FPI output measures are allowed to contribute to the score equally, then the rankings are altered as in the second column. Column 3 demonstrates how the rankings change if economic outputs are allowed to contribute 50 percent of the score, whereas ecology and community make up 25 percent each, and column 4 does the same for a 50 percent contribution of community. These last columns show how flexible the FPI ranking system can be. If policy makers are more concerned with community strength, then they should use rankings similar to those in the fourth column. If they are more concerned with ecological health or economic growth, then there are many alternate weighting schemes that could be employed.

This table demonstrates that the relative ranking of fisheries is very sensitive to the way we define success, particularly when considering fisheries located in developing countries—there is much more movement in the rankings for fisheries in these countries. Note that out of the nine recent African SSFs, the Liberian fisheries score highest when ecology alone is the metric, but once economic measures are incorporated, their rankings fall and they are outperformed by the Kenyan octopus fishery that scored very low in ecology but high in economics. The fisheries in Ghana and Sierra Leone (Tombo) also move up in the rankings once community concerns are weighted more heavily.

The report is organized as follows: Chapter 2 presents the results for FPIs that measure the success (Outputs) in achieving the triple bottom line of environmental, social, and economic sustainability. Chapter 3 presents the results for FPIs that measure factors (Inputs) that enable (or undermine) the likelihood that the triple bottom line will be achieved. Chapter 4 presents the simple graphic correlation between FPI inputs and outputs. Chapter 5 summarizes the lessons to be inferred about effective management strategies from this study.

Comparisons were constructed across several subgroups:

- **All Recent Africa:** Average for the nine African SSF FPI case studies done in June/July 2013.
- **All Harvest rights-based management:** Average for the 16 fisheries in the database that score a 4 or 5 in the measure "Proportion of Harvest Managed with RBM." These are fisheries in

TABLE 1.1. FPI RANKINGS

Fishery	Outputs Performance			
	Ecology Only	Equally Weighted	Eco. Weighted	Comm. Weighted
Lobster - Iceland	1	1	1	1
AK Halibut - United States	2	6	5	8
AK Pollock - United States	2	2	2	2
AK Salmon - United States	2	14	21	19
Cod - Norway	5	5	7	6
Purse Seiners - Norway	5	4	6	5
OR Dungeness Crab - United States	7	13	14	18
Hoki - New Zealand	8	3	3	4
Gulf Prawn - Australia	9	7	8	3
Suruga Pink Shrimp - Japan	9	9	9	9
AK Crab - United States	11	8	4	7
Lake Victoria Dagaa - Uganda	11	27	28	34
Lake Victoria Tilapia - Uganda	11	26	26	28
Louisiana Shrimp - United States	14	15	15	16
Baltic Cod - Sweden	15	11	11	11
Beel Chatra - Bangladesh	15	21	22	22
Artisanal - Liberia	17	25	27	24
CA Urchin - United States	17	17	12	20
Kailin Nadi - Bangladesh	17	31	36	35
Nearshore Artisanal - Seychelles	17	12	13	12
Semi-Industrial - Liberia	17	28	32	30
Anchovy - Peru	22	19	18	17
Artisanal Sole - Gambia	22	24	24	25
C (Southern Zone) - Morocco	22	18	17	14
FL Spiny Lobster - United States	22	16	16	13
Semi-Industrial - Seychelles	22	10	10	10
Pabna - Bangladesh	27	39	39	40
A+B (Central Zone) - Morocco	28	23	25	21
Artisanal Snapper - Indonesia	28	30	31	33
Pacific Groundfish - United States	28	22	20	23
Sea Cucumber - Seychelles	31	20	19	15
TRY Oysters - Gambia	31	48	48	48
Lake Chiuta - Malawi	33	40	40	43
Artisanal Axim - Ghana	34	35	37	29
Blue Crab - Philippines	34	37	34	39
Nile Perch - Uganda	34	33	30	36
Artisanal Shimoni - Kenya	37	42	41	44
Artisanal Demersal - Liberia	37	45	45	45
Aristanal Demersal - Senegal	37	43	43	41
Demersal 2010 - Senegal	37	34	33	31
Sherbro - Sierra Leone	37	44	44	42
NE Groundfish - United States	42	36	35	37
Shrimp Industrial - Colombia	42	32	29	26
Tombo - Sierra Leone	42	41	42	38
Artisanal Demersal - Ghana	45	47	47	46
Octopus - Kenya	45	29	23	27
Shrimp Artisanal - Colombia	45	38	38	32
Tangh Hua - Vietnam	48	46	46	47

Source: Collected by authors and Anderson et al., forthcoming.

Note: The most recent African SSF case studies' names are shaded in pink and the fisheries shaded in blue are located in developed nations.

Key: Eco. = Economically; Comm. = Community; AK = Alaska; OR = Oregon; CA = California; FL = Florida; TRY = TRY Oyster Women's Association; NE = New England.

which individual or community quotas that allocate the right to a given number of fish are the predominant form of management.

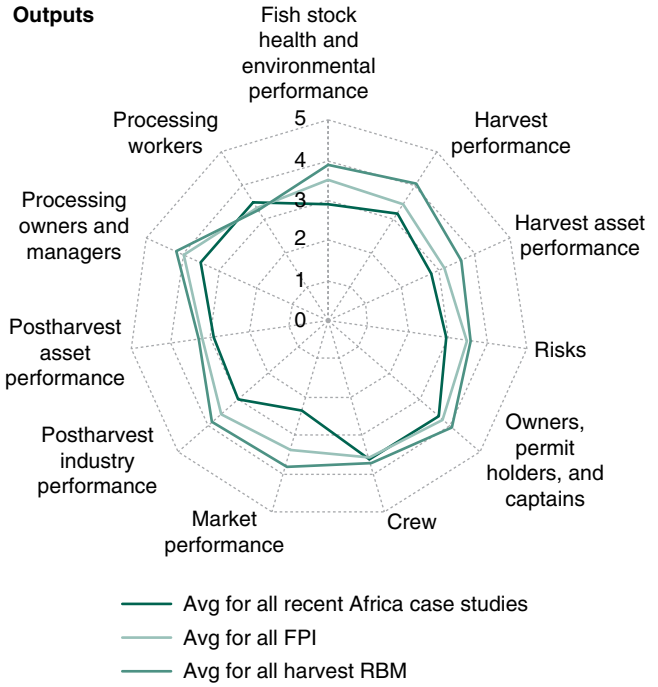
- **All Limited Access:** Average for the 27 fisheries that score a 4 or 5 in the measure "Proportion of Harvest Managed under Limited Access." These are fisheries in which permits are allocated and there is a limit on the number of vessels/individuals who are given access to the resource. Note that fisheries that also allocate quotas in addition to permits will also be included in this category—there is overlap between All Harvest RBM and All Limited Access.
- **All FPI:** Average for all 48 fisheries currently in the FPI database.
- **All Located in Developing Countries (LDC):** Average for the 31 fisheries that are located in developing countries.
- **All Africa:** Average for the 22 fisheries that are located in Africa.

CHAPTER TWO
FPI OUTPUT SCORES—MEASURING WEALTH

The main *output* components of the FPIs include stock performance, harvest sector performance, and postharvest sector performance. Each output component is broken into several key dimensions, each of which is a composite of several individual measures (see appendix A for details). This chapter demonstrates the results as FPI output scores between the African SSFs and the other comparison groups. Figure 2.1 compares the average score on each output dimension across the recent African SSFs, the entire FPI database, and the subset of FPI fisheries that are managed using harvest rights (quotas). It shows clearly that there are large performance gaps in the recent African SSFs for fish stock healthy status, risk resilience, market performance, and postharvest industry performance. The case-study fisheries also lag behind in harvest performance, harvest asset performance, and postharvest asset performance. They appear to slightly outperform the rest of the database in wealth accumulating to processing workers, which might be attributed to the fact that the majority of these processing workers in African SSFs come from the local community, whereas they are often outsiders in those more advanced fisheries in developed countries. Figure 2.1 also demonstrates that harvest rights tend to improve the wealth-generating performance of the fishery, particularly along the dimensions of environmental performance and harvest performance. The analysis in this chapter focuses on the role played by individual ecological, economic, and community measures and demonstrates how the FPI scores can yield a framework for rigorous econometric comparison of fishery wealth generation.

Table 2.1 depicts the average score for all case-study fisheries and some relevant comparison groups across each of the three output sustainability categories. It appears that the gap between the recent African SSF performances is the largest in ecology and economics and the smallest in community indicators. The case-study fisheries appear to be underperforming in most dimensions even relative to other African fisheries. This could be because the case-study communities were targeted based on their poor ecological status and the majority of the fisheries surveyed are artisanal

FIGURE 2.1. AVERAGE SCORES FOR FPI OUTPUT INDICATORS



Source: Collected by authors and Anderson et al., forthcoming.

fisheries that are producing fish for local consumption and not targeting export markets. The rest of this chapter provides a detailed explanation on the results of the triple bottom line.

ECOLOGY

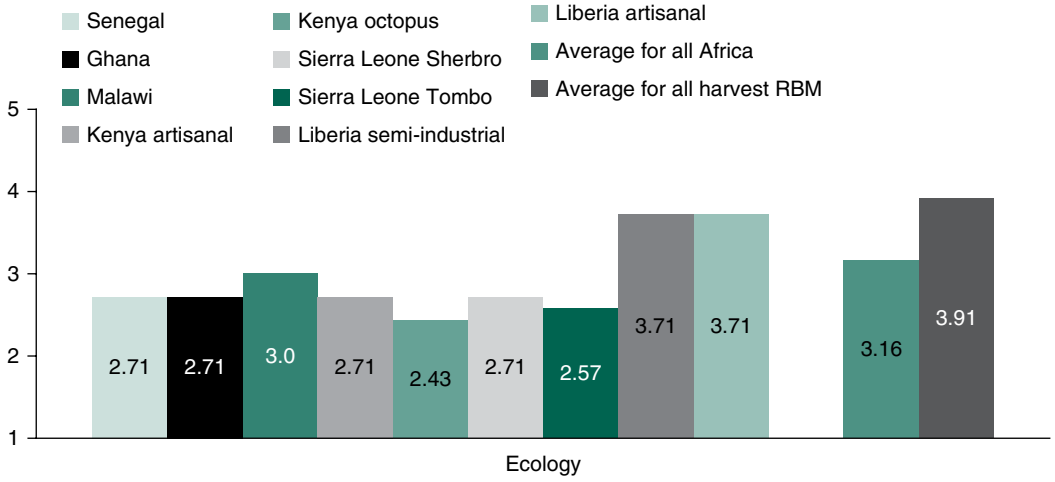
The ecological performance of the case-study fisheries is very low relative to the rest of the database and especially relative to fisheries with effective harvest rights. Figure 2.2 summarizes the performance of each fishery along ecological measures. The case-study fisheries perform even worse than the average African fishery, which might be due to the fact that these fisheries were targeted for intervention because of unhealthy fishery stock status. The recent FPI scores should be considered as a baseline of performance before implementation of the proposed management interventions. The only exceptions to the norm of abysmal ecological indicators are the Liberian fisheries. Part of the reason is the success of a trawler spotter program implemented

TABLE 2.1. FISHERY PERFORMANCE INDICATORS (OUTPUT SUSTAINABILITY AVERAGE)

Sustainability Category	Avg. All FPIs	Avg. All Africa	Avg. Case Studies	Sierra Leone Tombo	Sierra Leone Sherbro	Ghana Artisanal	Liberia Semi-industrial	Liberia Artisanal	Kenya Artisanal	Kenya Octopus	Malawi	Senegal
Ecology	3.5	3.2	2.9	2.6	2.7	2.7	3.7	3.7	2.7	2.4	3.0	2.7
Economics	3.4	3.1	2.8	2.6	2.7	2.8	2.9	3.0	2.7	3.4	2.8	2.6
Community	3.7	3.5	3.6	3.9	3.4	4.0	3.7	3.7	3.2	3.7	3.1	3.5

Source: Collected by authors and Anderson et al., forthcoming.

FIGURE 2.2. AVERAGE SCORE FOR ECOLOGY OUTPUTS



Source: Collected by authors and Anderson et al., forthcoming.

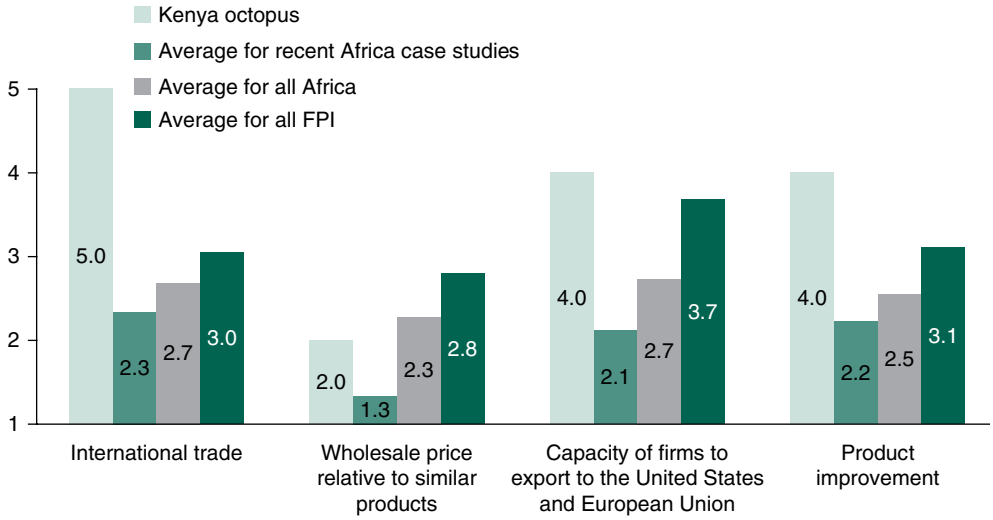
in 2009 that has been effective at keeping illegal industrial trawlers out of inshore zones. The danger of such a program is that artisanal and semi-industrial fleets may see short-term ecological gains in the form of increasing stocks. If no attempt is made to limit their capacity, then these gains will be eroded by increasing effort from the artisanal sector. The Kenyan octopus fishery scores lowest in the attainment of ecological sustainability because this has recently become an export fishery in which harvesters have large incentives to overfish. The case-study fisheries are much more prone to overfishing, illegal landings, and degrading of critical habitat than the average FPI fishery.

ECONOMICS

The recently scored SSFs in Africa perform lower than average along economic measures, particularly in the postharvest sector. The economic performance of the fisheries is very low relative to the rest of the database and especially relative to fisheries with effective harvest rights. This might be due to the fact that the majority of the surveyed African SSFs target local markets and their main product is of low value, for example, smoked, dried, or fermented fish that is processed for local consumption with the aim of preserving the maximum amount of fish with low capacity. It is evident that the average recent African SSF has a low percentage of landings going to international trade, very few processing facilities that are certified to export to the European Union (EU) or the U.S. markets, and a low proportion of harvest undergoing product enhancement (which is defined as the proportion of harvest going into certified, branded, fresh premium, portioned, live, or value-added products). This contributes to very low postharvest wholesale prices relative to similar products and inhibits the fisheries from extracting maximum economic rents from their value chains. According to the FPI scoring methodology, the production of low value-added products decreases economic performance, and targeting international markets through product improvement is one route toward increasing the economic benefits that accrue through the fishery. Currently, the majority of the case-study fisheries lack the infrastructure, capital, and training in sanitation necessary to process fish with the goal of product improvement.

As demonstrated in figure 2.3, the only exception to poor economic performance is the Kenyan octopus fishery in which processors from the coastal hub of Mombasa play a large role in targeting export markets. The postharvest sector of this octopus fishery performs particularly well with regard to ex-vessel to wholesale margins and the facilitation of international trade. Prior research in the Indonesian and Philippines blue swimming crab fisheries (Chu, Anderson, and Anderson 2012) suggests that processors can play a pivotal role in sustainable management of fishery resources; in the Philippines, processors

FIGURE 2.3. AVERAGE FOR POSTHARVEST SECTOR ECONOMIC PERFORMANCE



Source: Collected by authors and Anderson et al., forthcoming.

insist on a minimal size for all the crab they buy, which contributes to sustaining the stock and prohibits overfishing. In the absence of effective federal or local management, processors have a vested interest in ensuring the sustainability of the stock, especially if they have sunk capital investments in the form of facilities and improved technology. The Kenyan octopus fishery is experiencing short-term economic gains relative to the rest of the Kenyan artisanal fishery by targeting export markets, but for these gains to be sustained in the long run, the processors need to promote sustainable harvest strategies.

The African SSFs also underperform in variables that relate to the harvest sector. The case-study fisheries have a low ratio of harvest asset value to gross earnings, the majority of harvest sector capital investments are facilitated by informal credit arrangements, and the average age of the vessels is high. Vessel maintenance appears to be a high priority in many fisheries; this is predominantly out of necessity as vessels are primarily made of wood and require constant maintenance to remain seaworthy.

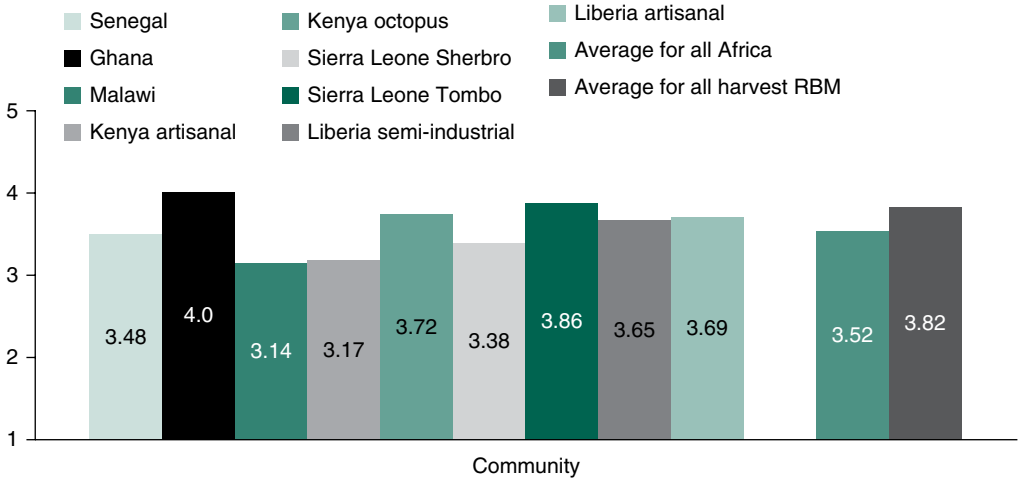
Another informative comparison in the harvest sector is along the dimension of risk. The volatility measures in the FPI database reflect a risk-based impediment to achieving higher levels of wealth and the extent to which they can be controlled. Risk in the fisheries may inhibit investment and prevent the development of high-value supply chains.

The recent African SSF samples experience more annual fluctuation in total revenue, landings, and prices than the average African fishery or database fishery. The instability fostered by such oscillations inhibits harvest sector investments and efficient exploitation of the resource. As a lake fishery, Malawi is an exception to the rest of the recent studies and the annual harvests and landings are significantly more stable in this fishery.

COMMUNITY

The community performance of the recent African SSFs is much closer to the average for all FPI fisheries than the ecological or economic outcomes (figure 2.4). This might be because community measures are scored relative to local alternatives and not entirely on a global scale. The fishery scores high in generating community income if fishing is a desirable occupation that affords participants a lifestyle that is high in amenities relative to other members of the community. The average participant in these predominantly rural fisheries has access to basic and simple drug treatment at the local pharmacy, with occasional access to nurses or medical practitioners for emergencies. They can also afford to send their children to middle school or simple technical training. Community scores are driven upward by the participation of local residents compared with outsiders; the recent case studies have the majority of harvesting and processing undertaken by locals, whereas many high-revenue fisheries attract participants from outside

FIGURE 2.4. AVERAGE SCORE FOR COMMUNITY OUTPUTS



Source: Collected by authors and Anderson et al., forthcoming.

the community who may extract resource wealth without contributing to local economies. On average, from 70 to 95 percent of participants come from the local fishing community, with processing owners being more likely to come from outside the village. The fisheries in Ghana, Kenya (octopus), Sierra Leone (Tombo), and Liberia score particularly high along community dimensions. These fisheries are generating livelihoods that permit wealth to accumulate in local communities and allow participants to access health, education, and high social standing.

The two community measures in which the case-study fisheries score lowest relative to the rest of the database are harvest safety (an average of 0.5 to 1 death per thousand persons per fishing season) and sanitation at landing/processing sites. The low harvest safety scores can be attributed to the small size of the average vessel (even those that undertake long voyages in the open ocean) and the lack of nationally funded search and rescue teams. On average, there are functional toilets available (often pit latrines), but fish or fish handlers are exposed to untreated sewage. This can be compared with the FPI average level of sanitation, which is adequate for handling of human waste and basic handling of fish waste (not entirely up to global health standards).

The FPI scores allow us to analyze the equity within the fishery. It has been posited that increased harvest rights improve ecological and economic outcomes at the expense of equitable distributions. Those at the top of the value chain (harvest quota owners and processing facility owners) may accumulate wealth at the expense of others who are excluded from the fishery or hired at low wages. The FPI database shows that fisheries with strong harvest rights do tend to see more wealth accumulating to the harvest and processing capital owners, but this does not seem to come at the expense of the harvest and processing crew who are no worse off than in fisheries without strong property rights. In comparison with the rest of the database, the average wealth distribution in the recent African SSF is very close to being equal. The outlier is the Kenya octopus fishery that relies on export processing and shows clear accumulation of wealth to boat captains and processing facility owners. When compared with the remainder of the Kenyan artisanal fisheries, the octopus harvest crew is doing slightly worse, but there are gains in all other occupations.

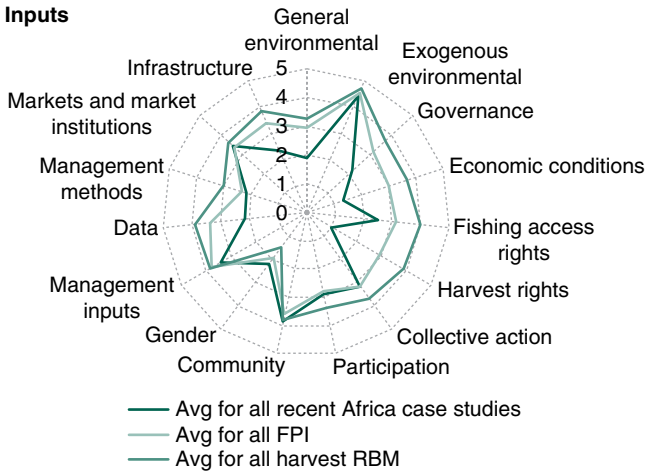
CHAPTER THREE
FPI INPUT SCORES—ENABLING WEALTH CREATION

The main *input* components of the FPIs include macroenvironment, property rights, comanagement, management, and postharvest. Each input component is broken into several key dimensions, each of which is a composite of one to six individual measures (see appendix B for details). Importantly, the structure of the FPIs does not presuppose whether, how, or how much these inputs support wealth creation. The FPI scores merely facilitate data analysis to determine the empirical causal or correlative relationships between these inputs and the different dimensions of wealth creation. This chapter demonstrates the results of FPI input scores between the African SSFs and the other comparison groups.

Figure 3.1 compares the average score on each input dimension across the recent African SSFs, the entire FPI database, and the subset of FPI fisheries that is managed using harvest rights (quotas). **It shows that there are large performance gaps in the recent African SSFs with regard to macroindicators such as general environmental performance (measured by the country's Environmental Performance Index); governance (World Bank indicators); and economic conditions (measured by Index of Economic Freedom and gross domestic product).** The case-study fisheries also lag behind in general environmental performance, governance, economic conditions, access rights, harvest rights, data management, and infrastructure.

All of the recent African case-study fisheries are relatively data poor. The average African SSF has available data based only on small samples with much missing data that impedes making the inferences needed for management. Even when data on landings exist, they are used only inconsistently or irregularly, as shown in the average data analysis score. In Senegal, for example, they score very high in the collection of ex-vessel price and quantity data but these data are rarely analyzed to inform policy decisions and may be collected by federal agents without being distributed to local authorities. Despite the proliferation of cellular phones, price and quantity information are often inaccurate, delayed, or available to only a few and very little historical data

FIGURE 3.1. AVERAGE SCORES FOR INPUTS



Source: Collected by authors and Anderson et al., forthcoming.

are recorded. The exercise of collecting the FPI scores demonstrates that **even in such data-poor fisheries we can still obtain accurate quantitative scores that facilitate comparison and inference.**

In addition, all of the fisheries recently profiled have lesser infrastructure than the average African fishery and the average FPI database fishery. Many of the recent fisheries are in remote locations where ocean/air shipping from landing site to port of export is available only irregularly. The roads are most likely to be poorly maintained gravel or paved two-lane roads at best. Technology adoption is limited to cellular phones and there are no sophisticated fish finders or production technology as is the norm in other fisheries. Where electricity is available, supply chains often lose produce because of irregular fuel supply or unreliable generators. Importantly, ice is available, but not in sufficient quantities to meet the demand. It is often reused and is not applied to the entire catch throughout the supply chain, which explains why product improvement is often so low. If fish is not sold fresh within hours of landing, then it will be smoked, dried, or fermented as a necessary means of preserving the catch, not adding value.

A dimension in which the recent case studies score relatively high is markets and market institutions, probably because these fisheries tend to have competitive landings pricing systems with lots of buyers and very few official tariff/nontariff barriers to international trade. Vertical integration could also be considered prevalent because men in the harvest sector often sell fish to their wives in the harvesting sector; if households pool income, then this is a form of vertical integration.

In the remainder of this section, the analysis focuses on a few key roles played by individual input measures and demonstrates how the FPI scores can yield a framework for rigorous econometric analysis of the pathway for enabling fishery wealth accumulation.

RIGHTS

The FPIs collect data on the status of existing rights and responsibilities along two dimensions: access rights and harvest rights. Access rights are defined as those that grant the user the rights to access the resource and harvest rights are those that give the user property rights over a set quantity of the harvest (generally community or individual quotas). Access rights can range from a regulated open access scenario, wherein a local beach community has been given control over who fishes from their beach and they choose to grant an unlimited number of permits, to a limited access scenario, wherein there is an enforced cap on the number of vessels that are allowed to fish and these vessels are granted tradable permits. All of the fisheries scored recently can be classified as regulated open access. There is a local authority who must be consulted before accessing the resource but these authorities have chosen not to limit the number of harvesters, which undermines their ability to exercise control over the sustainability of the resource. **There is very little effort to limit entry in any of the recent African SSFs, which means that they score moderately well in the existence of access rights but very low in the exclusivity of these rights.**

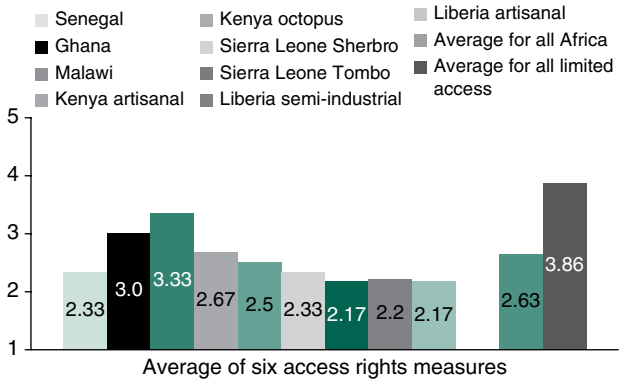
Harvest rights are separate from access rights in that they grant property rights over a fixed quantity of fish and are predominantly in the form of a Total Allowable Catch coupled with community or individual quotas. The definition is more complex when we consider sedentary fisheries with spatial property rights because these have effectively guaranteed rights over a portion of the harvest. However, all of the recent fisheries are for nonstationary species and none of the management regimes make an effort to assign

rights to a portion of the harvest so that all of these fisheries score a "1" in harvest rights (indicates that these rights do not exist).

Both access and harvest rights are scored along six different measures in an attempt to accurately portray the status of rights along the lines of existence, transferability, security, durability, flexibility, and exclusivity. **This operates under the assumption that more strongly enforced rights that are felt to be more secure and grant the user flexibility and transferability will have a different impact on outcomes than will rights that exist but are subject to dilution and infringement.** Unlike the harvest rights scores in the recent fisheries, the access rights scores did vary across fisheries. This is due to differences in the exclusivity of the access rights (some had more intrusion from industrial trawlers or aquarium fishers); in the flexibility of the access rights (some were subject to very strict gear/area restrictions); and in the security/durability of the access rights (certain fisheries had a very strong tradition of de facto open access whereas others were subject to arbitrary federal government decisions).

The variation in access rights is evident in figure 3.2. The average for the recent case studies is much lower than the average in fisheries that were characterized as limited access (a cap placed on the number of vessels). Access rights in Malawi were the strongest because there was a higher degree of exclusivity than elsewhere; there were fewer incursions from outsiders because of the remote nature of the lake fishery. Ghana also scored relatively high because of the strong tradition of de facto rights that influenced participants' perceptions of security and durability. Liberia scored slightly higher than they would have otherwise because of the recent trawler spotter efforts, but they still suffer from low security scores because of the unstable nature of the national government.

FIGURE 3.2. AVERAGE ACCESS RIGHTS INPUTS SCORES



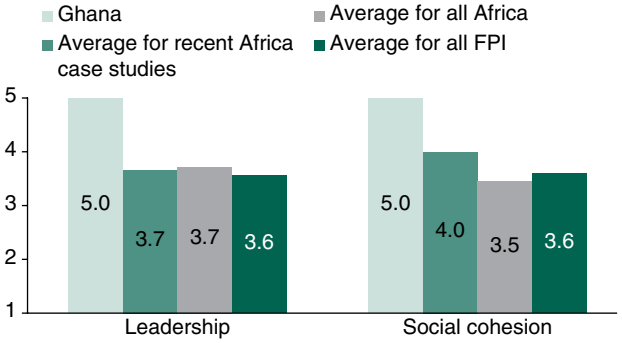
Source: Collected by authors and Anderson et al., forthcoming.

COMMUNITY COMANAGEMENT

The case-study fisheries score higher than the average FPI fishery in the comanagement dimensions of collective action, participation, and community. To test Eleanor Ostrom's hypotheses on the role of social capital such as trust and reciprocity in resource outcomes (Ostrom 1990), the FPIs collect data on community comanagement variables such as leadership and social cohesion. For leadership, the fishery is scored based on whether there is a widely recognized individual leader or a small group of individual leaders who provide vision for management and are able to attract stakeholders to that vision. For social cohesion, fisheries are scored based on the existence of social capital—meaning that the resource users are socially connected and interact regularly in fishing and nonfishing spheres.

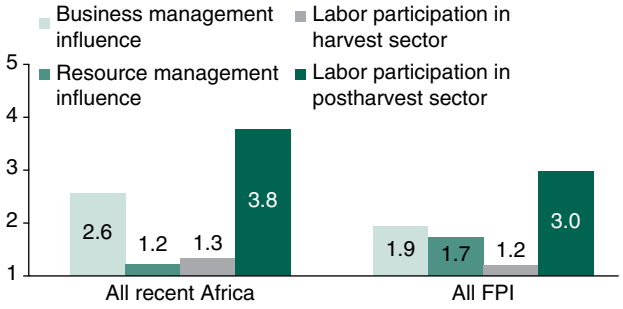
As shown in figure 3.3, the recent fisheries scored above the FPI average in leadership and much higher in social cohesion. This is primarily due to the role of traditional authorities as national governments in Africa are seldom able to effectively lead centralized management systems. In the case of Ghana, the scores are exceptionally high because they have had centuries of traditional leadership from the Chief Fisherman and Fish Mommy who govern the harvest and postharvest sectors, respectively, with absolute authority. Ghanaians of diverse religious beliefs still honor the Sea God, and the Chief Fisherman derives his authority directly from people's unwillingness to anger this god by disobeying fishing regulations. Within the region, Ghanaians are renowned as expert fishermen and their heritage of shared cultural norms and centuries of fishing experience are demonstrated in their high social cohesion scores.

FIGURE 3.3. AVERAGE LEADERSHIP AND SOCIAL COHESION SCORES



Source: Collected by authors and Anderson et al., forthcoming.

FIGURE 3.4. ROLE OF WOMEN IN FISHERIES



Source: Collected by authors and Anderson et al., forthcoming.

GENDER

In general, the role of women was very similar across the case-study fisheries; women are dominant in the postharvest sector. A total of four measures are used in the FPIs to describe the influence of gender (figure 3.4). The first looks at their influence on business management (including harvest and postharvest businesses); it is shown in the graph that women in the recent African case-study fisheries have balanced business influence with men, whereas in other fisheries, the men tend to dominate the business sector. If the measure was exclusively for postharvest businesses then the African SSFs would score even higher. Similarly, the second measure looks at women's influence over resource management; owing to the dearth of women in positions of power on the community management associations (CMAs) or the national fisheries organizations, this score is low. The last two measures clearly show that across all fisheries women are more likely to be involved in the postharvest sector, particularly in the recent studies in which an average of 60 to 80 percent of processors were female.

There are a few exceptions to this general delineation of gender roles. In the Kenyan fisheries, women were slightly more likely to be involved in harvesting; in Malawi, there were a larger than average number of men involved in processing. The Ghanaian fishery demonstrated a high degree of female participation in businesses because of the traditional role of the "Fish Mommy" or "Fish Queen" who is the local authority on postharvest operations. This Fish Mommy exercises a high degree of control over the local market because she sets the prevailing price at the beginning of each trading day by examining the first three landings and making a judgment on the market price of that day. For the remainder of the day, her price is the standard at which fish is traded with discounts for lower-quality products. This degree of influence by women is far greater than that of most developed country fisheries where both harvest and postharvest sectors tend to be dominated by men.

CHAPTER FOUR
HYPOTHESIS TEST

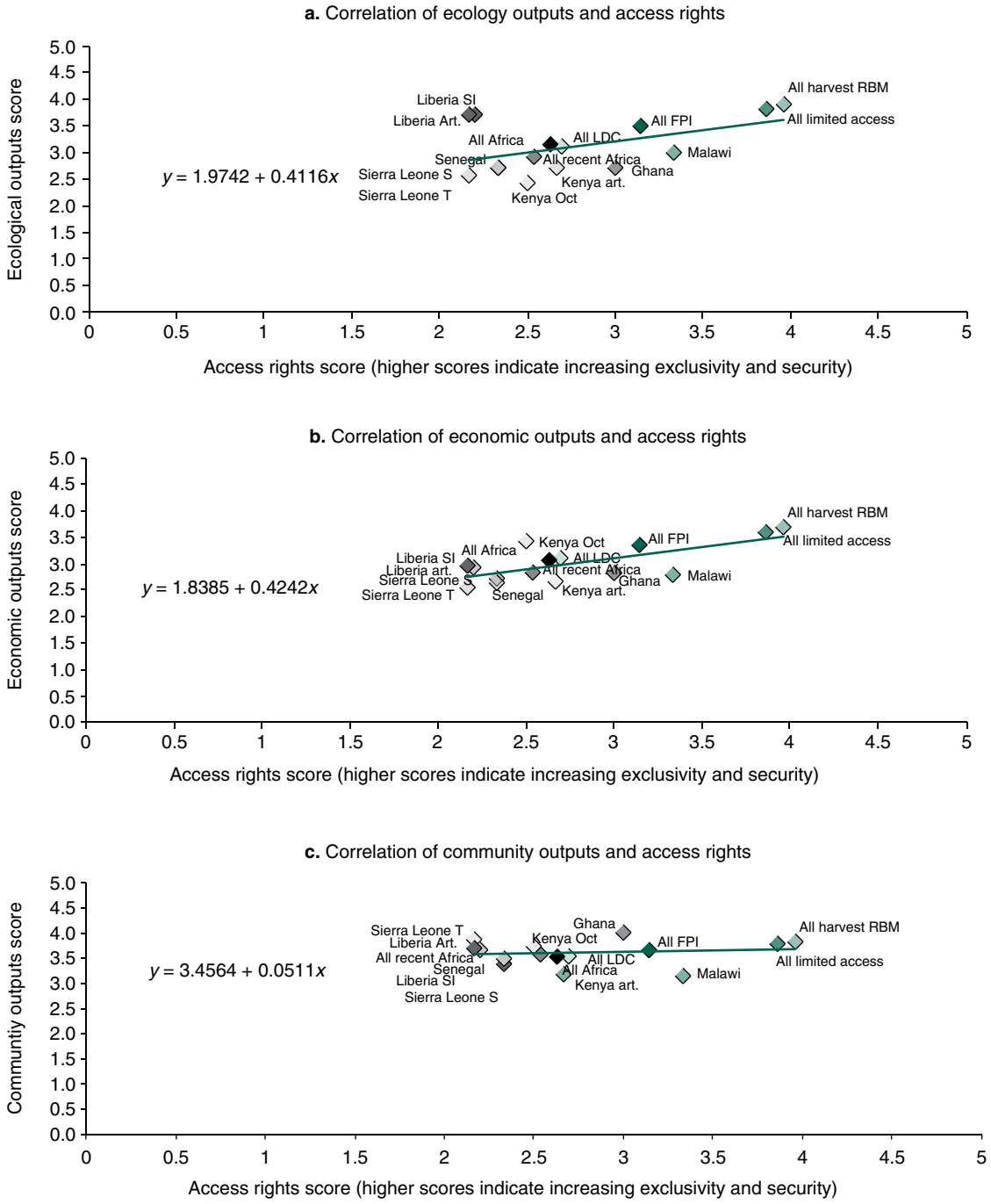
The FPIs are designed to allow researchers to test for causal relationships between the wealth-enabling inputs and the outputs that represent wealth accumulation, as well as other hypotheses related to the ecological, social, and economic dimensions of fisheries. This report does two preliminary graphic tests of correlation to show what can be done by using the FPI database.

Hypothesis (i): Increased rights over management of the resource lead to improved ecological, economic, and community outcomes (in both harvest and postharvest sectors).

Figure 4.1 tests for correlations between access rights and the attainment of the triple bottom line. The variable on the horizontal axis is the average of all six access rights input measures (existence, transferability, security, durability, flexibility, and exclusivity); therefore, increases along this access can be interpreted as a strengthening in the exclusivity and security of an individual's rights and not an extension of access rights to a greater number of individuals. The variable on the vertical axis changes in each graph, but it is the average of all output measures that either deal with ecology, economics, or community. Access rights refer to a set of enforced regulations that give harvesters the right to determine who can access the resource. In the recent African SSF case studies, all of the fisheries had official organizations (predominantly at the local landing site level) that were granted the authority to determine who could fish or land from their beaches. However, as was previously discussed, none of the fisheries made a strong attempt to limit the amount of harvesters who were allowed to fish. When permits existed, there was no cap on the number allocated and the de facto right to open access trumped any effort to limit participants. In this sense, none of our fisheries are limited-access fisheries in the way that the term is used by economists. (The "All limited access" data point does not include the case-study fisheries. It averages across the scores of fisheries in which there is an enforced limit on the amount of vessels allowed to access.)

Increasing the exclusivity of access rights leads to improved ecosystem health and less overfishing. The Liberian fisheries in particular are outliers because they score relatively low in exclusivity and security, yet have high ecological

FIGURE 4.1. CORRELATION OF ECOLOGY, ECONOMIC, AND COMMUNITY OUTPUTS SCORES AND ACCESS RIGHTS

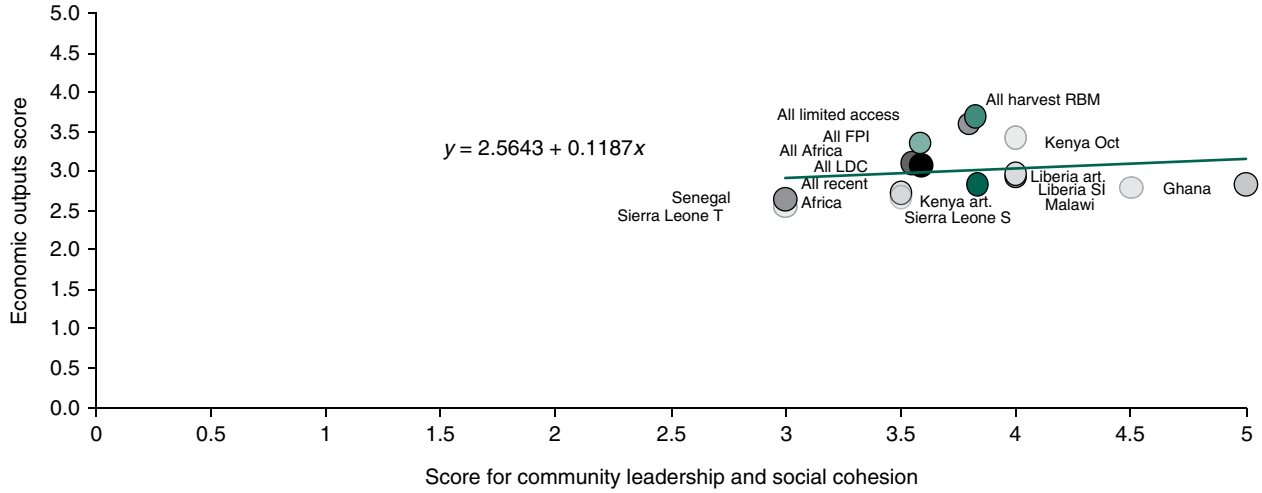


Source: Collected by authors and Anderson et al., forthcoming.

scores. In addition, implementing strong access rights leads to better economic outcomes such as decreased volatility, higher earnings, and more value added in the postharvest sector. In the community correlation plot, we see no evidence that limiting access and making it more exclusive corrodes the health of communities; there is a slight positive correlation between exclusive access rights and fishery participants' access to health/education.

The results showed that **increasing the exclusivity and stability of access rights leads to large improvements in the ecological and economic**

FIGURE 4.2. CORRELATION OF ECONOMIC OUTPUTS AND COMMUNITY INPUTS (LEADERSHIP AND SOCIAL COHESION)



Source: Collected by authors and Anderson et al., forthcoming.

scores but has zero impact on community scores. Although the results are not presented here, we also found that the additional implementation of harvest rights that give users a secure share of the landings further increased ecological and economic scores while still having no impact on community sustainability.

Hypothesis (ii): Ostrom's theory that communities with strong social cohesion and a vision for leadership will have better outcomes.

There is very little evidence from the FPI database to show that social cohesion and leadership alone are sufficient to ensure that harvesters and processors earn high wages, can access health/education, and have high social standing (figure 4.2). In addition to the data from the most recent round of African SSF case studies, we also use the set of relevant comparison fisheries (All FPI, All Africa, All Harvest RBM, All limited access).

As a disclaimer, these graphs should not be taken to represent rigorous economic analysis as they are very preliminary and no effort was made to control for confounding factors such as macroeconomic variables that might be correlated both with successful RBM and improved outcomes. They should be interpreted as raw correlations but nonetheless yield some striking results that will inform future research using the FPI data. At the very least, they tell us whether there is any support at all for the theories of fisheries management outlined above.

CHAPTER FIVE
HIGHLIGHTS OF KEY FINDINGS AND RECOMMENDATIONS

The findings in the preceding sections lead us to the following conclusions.

(a) **The FPIs are a useful tool for data-poor fisheries because they provide cost-effective yet holistic estimates of the existing state of fisheries management by efficiently relying on the input of local experts.** Fisheries can be scored by using the FPI framework in only one to two weeks, yet the information gathered provides insight into economic and social variables that are traditionally ignored in fisheries management benchmarking. Collection of quantitative FPI data led to a high degree of variation in scores across the nine individual case-study fisheries, which allowed us to make interesting comparisons across management regimes. There was not a correspondingly high variation in the confidence scores of our experts, which leads us to conclude that these scores are reasonably accurate and the specificity of the scoring bins used by the FPIs permits us to compare scores across both developed and developing countries. The FPIs are not a substitute for more detailed household and firm-level data that could be used to drill down and uncover the causal relationships that underlie some of the more interesting trends we observed, such as whether processor-driven market integration leads to higher economic scores or more exclusive access rights contribute to ecological and economic sustainability but not to community welfare. However, the FPIs are a necessary starting point from which to observe more macrolevel trends and lend insight into the avenues that will be more fruitful for more detailed survey work.

(b) The variability of fishery rankings when done according to ecology, economics, or community FPI output scores leads us to conclude that **ecological variables are not suitable proxies for economic welfare or community well-being.** Fisheries that score high in environmental sustainability do not necessarily contribute livelihoods and economic growth to the communities where they are based. Economic and social variables cannot be omitted and replaced exclusively with stock assessments. This makes a case for continuing to collect data on economic and social variables and not neglecting these areas in favor of exclusive focus on stock assessments.

(c) **Access and harvest rights appear to be positively correlated with ecological and economic sustainability, whereas other inputs such as leadership and social cohesion do not contribute to the same increase in scores.** Although some fisheries management experts have predicted that the implementation of RBM will lead to higher levels of inequity within the fishery, the lack of declining community scores with more exclusive rights arrangements leads us to conclude that this is not true. The improvement in access to education and health care offsets the decline in local ownership so that community scores remain stable. These preliminary results suggest that **interventions will have a stronger impact if they target the enforcement of stable, durable, transferable, flexible, and exclusive access rights agreements rather than focusing on empowerment and cooperation within the community.** Although these two strategies are certainly interlinked and not necessarily mutually exclusive, based on several examples from the case studies, it appears that more formal and exclusive rights arrangements do not necessarily follow from strong local leadership, particularly when the macrolevel governance is unstable or when the infrastructure and capital for product improvement are missing.

(d) **FPI data should be collected regularly to track the progress and impact of interventions.** This report demonstrates that collecting data on the FPIs provides decision makers with valuable baseline data on the ecological, social, and economic performance of their fishery and also allows for informative comparisons across fisheries. The FPIs have the power to test hypotheses from a range of social science models and are constructed to measure enabling factors alongside a multitude of outcomes. Even in the short term, cross-sectional analysis permits policy makers to draw useful conclusions about the relative importance of factors such as property rights, infrastructure, leadership, and other management inputs, but a more rigorous test of hypotheses from a range of social science models will be possible only if FPI data are collected in the same fisheries over time. In the long term, repeated collection of FPI data within a given project is an important component of evaluating and monitoring the investments in fisheries management. Data should be collected within these case-study fisheries at regular intervals so that managers can map the intermediate steps that accompany policy changes. Now that we have a baseline for these nine African fisheries, many of which are about to experience a strengthening in formal resource rights, we can anticipate long-term lessons that will be learned from tracking their evolution over time.

(e) Comparison of the recent case studies leads to the recognition of two key outliers: ecological outcomes in Liberia and economic outcomes in Kenyan octopus. We learned that trawler spotter programs such as the one operating in Liberia can be effective at generating short-term ecological gains and we recommend that the **community-based monitoring program be scaled up and accompanied by efforts to simultaneously limit the activity of smaller vessels so that stock recovery is not temporary.** The Kenyan octopus fishery suggests that a post-harvest sector focused on value addition and export is capable of generating large economic gains for boat owners and processing managers that do not appear to come at the expense of the local community. **Improvements in infrastructure should be coupled with strengthening tenure to enhance the efficiency of the value chain.** In the absence of effective federal or local management, processors have a vested interest in ensuring the sustainability of the stock, especially if they have sunk capital investments in the form of facilities and improved technology. The Kenyan octopus fishery is experiencing short-term economic gains relative to the rest of the Kenyan artisanal fishery by targeting export markets, but for these gains to be sustained in the long run, the processors need to promote sustainable harvest strategies.

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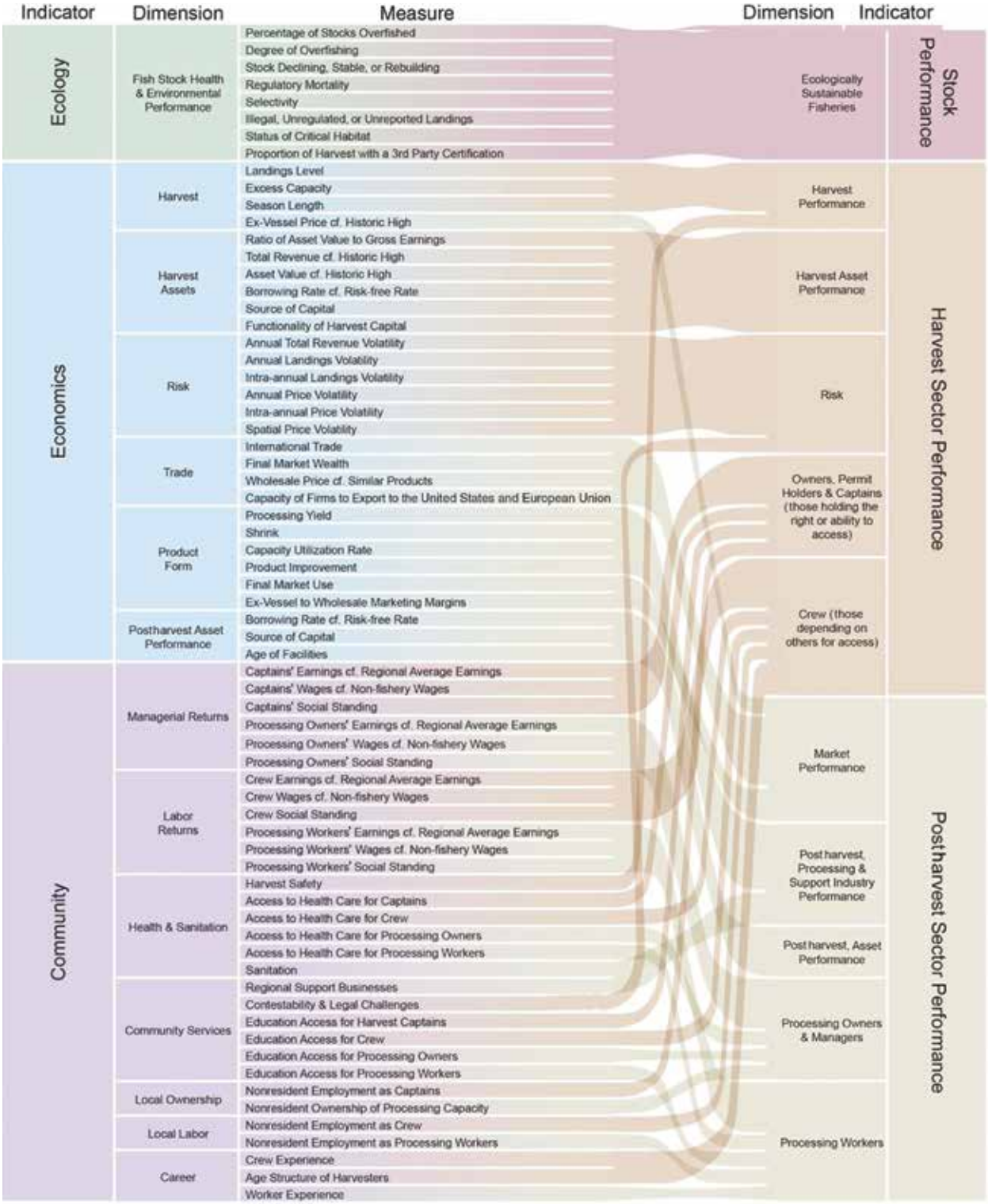
APPENDIX A
OUTPUT INDICATORS

TABLE A.1. OUTPUT INDICATORS, DIMENSIONS, AND MEASURES



Source: Anderson et al., forthcoming.

APPENDIX B
INPUT INDICATORS

TABLE B.1. INPUT COMPONENTS, DIMENSIONS, AND MEASURES

Component	Dimension	Measure
Macrofactors	General Environmental Performance	Environmental Performance Index (EPI)
	Exogenous Environmental Factors	Disease and Pathogens
		Natural Disasters and Catastrophes
		Pollution Shocks and Accidents
		Level of Chronic Pollution (Stock effects)
		Level of Chronic Pollution (Consumption effects)
	Governance	Governance Quality
		Governance Responsiveness
	Economic Conditions	Index of Economic Freedom
		Gross Domestic Product (GDP) Per Capita
Property Rights & Responsibility	Fishing Access Rights	Proportion of Harvest Managed Under Limited Access
		Transferability
		Security
		Durability
		Flexibility
		Exclusivity
	Harvest Rights	Proportion of Harvest Managed with Rights-based Management
		Transferability
		Security
		Durability
		Flexibility
		Exclusivity
Comanagement	Collective Action	Proportion of Harvesters in Industry Organizations
		Harvester Organization Influnce on Fishery Management & Access
		Harvester Organization Influnce on Business & Marketing
	Participation	Days in Stakeholder Meetings
		Industry Financial Support for Management
	Community	Leadership
		Social Cohesion
	Gender	Business Management Influnce
		Resource Management Influnce
		Labor Participation in Harvest Sector
		Labor Participation in Postharvest Sector
Management	Management Inputs	Management Expenditure to Value of Harvest
		Enforcement Capability
		Management Jurisdiction
		Level of Subsidies
	Data	Data Availability
		Data Analysis
	Management Methods	Marine Protected Areas and Sanctuaries
		Spatial Management
		Fishing Mortality Limits
Postharvest	Markets & Market Institutions	Landings Pricing System
		Availability of Ex-vessel Price & Quantity Information
		Number of Buyers
		Degree of Vertical Integration
		Level of Tariffs
		Level of Non-tariff Barriers
	Infrastructure	International Shipping Service
		Road Quality
		Technology Adoption
		Extension Service
		Reliability of Utilities/Electricity
		Access to Ice & Refrigeration

Source: Anderson et al., forthcoming.

APPENDIX C
CASE STUDY SUMMARY

This appendix provides an overview of each case-study fishery by summarizing the scores and key conclusions.

Source of the data was collected by each individual listed below:

- Ghana (Axim)—Wisdom Akpalu
- Kenya (Shimoni: Artisanal and Octopus)—Lorna Slade
- Liberia (Robertsport and Marshall: Artisanal and Semi-Industrial)—Robert Arthur/MRAG
- Malawi (Lake Chiuta)—Friday Njaya
- Senegal (Ngaparou)—Lamine MBaye
- Sierra Leone (Sherbro Estuary and Tombo)—Max Schmid

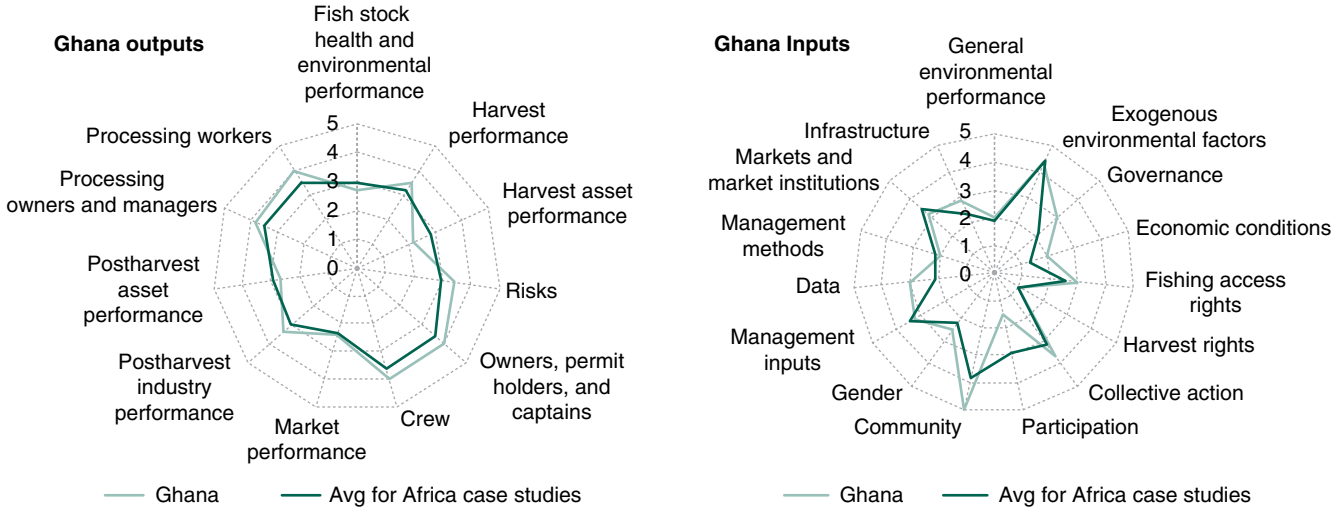
All the graphs in Appendix C, were created by the authors of this report, Jingjie Chu and Jennifer Meredith.

GHANA

TABLE C.1. SUMMARY OF GHANA ARTISANAL FISHERY IN AXIM

Fishery Type	Species	Gear	Characteristics	Management	Vessels
Artisanal	• Anchovy • Atlantic Little Tuna • Atlantic Sailfish • Barracuda • Blue Marlin • Bumper • Dolphin Fish • Halfbeak • Horse Mackerel • Moonfish • Rays • Red Pandora • Chub Mackerel • Shad/Bonga • Threadfin	• Bottom set net • Small drift net • Hook and line • Drag net • Drift gillnet • Ring net	• Two fishing seasons (Main: July–September; and Minor: November–January) • Major upwelling during bumper season; Minor upwelling in minor season • Fisherman reside in communities along the coast • Local Ghanaians engaged in the fisheries • About 80% of fish landed are processed (smoked 60% and salted 20%)	• Regulated open access • Local communities have strong sense of de facto entitlement • Traditional institutions: village chief, chief fisherman, and chief fish trader • Community-based Fishery Management Committees (CBFMCs) and District Fishery Management Committees (DFMCs) are being revamped to implement fisheries laws.	• One-man canoe (small canoe using paddle) • Small canoe (motorized) • Medium-size canoe (motorized) • Large canoe (motorized)  *Photo credit:* Paulinuk, Flickr.

FIGURE C.1. SUMMARY OF GHANA CASE STUDY OUTPUT AND INPUT SCORES



RELATIVE STRENGTHS

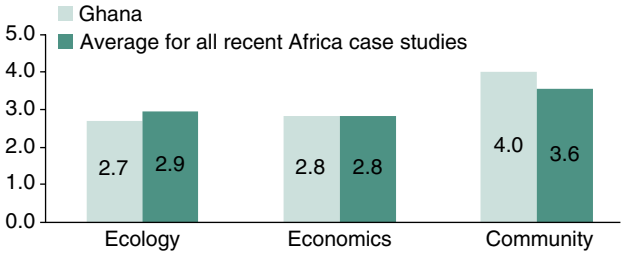
Economic indicators are average.

» Within the harvest sector, capital is quite well maintained. The fishermen set aside the off-fishing days, typically once a week, to mend their nets and maintain their boats.

» Annual catches and total revenue are relatively stable, which reduces exposure to risk.

» Within the processing sector, the firms have high capacity to export to Europe and the United States if the fish is certified by the Ghana Standard Authority.

FIGURE C.2. ECOLOGY, ECONOMICS, AND COMMUNITY SUSTAINABILITY FOR GHANA ARTISANAL FISHERY



Community indicators are above average.

- The artisanal fishery enjoys a very high level of harvest safety. One of the reasons provided is that the fishermen support one another at sea.
- Wealth seems to be accumulating in the harvesting and processing sectors. Fishery participants earn higher wages than the national average wage rate, and high school education is available in the community and affordable to the processors.
- There is evidence of industry financial support for management.

There is strong evidence of effective preexisting norms of comanagement in the form of social cohesion and leadership within the fishery. The Chief Fisherman and Fish Mommy are very effective at enforcing management and setting market prices because of the cultural norms and traditions surrounding the Sea God.

RELATIVE WEAKNESSES

Ecological indicators are slightly below average.

- At most, a quarter of the landings are certified.
- A large proportion of the stock is overfished and catch per unit effort has been declining over time.
- Although regulations exist to protect juvenile stocks, sea turtles, and gravid lobsters, the regulations are openly violated.
- The practice of pair-trawling and use of light aggregation equipment has led to high levels of illegal, unreported, and unregulated landings.

The fishery scores very low in participation, which means that comanagement inputs in the form of days in stakeholder meetings and financial support are very low.

LIBERIA

TABLE C.2. SUMMARY OF LIBERIA ARTISANAL FISHERY IN ROBERTSPORT AND SEMI-INDUSTRIAL FISHERY IN MARSHALL

Fishery Type	Species	Gear	Characteristics	Management	Vessels
Artisanal (Kru)	• Shallow and deep-water demersal • Small pelagics • Flying fish • Barracuda • Shark	• Cast nets • Floating and bottom gillnets • Hand lines • Set hook and line	• Highly seasonal (mainly fish in dry season) • Less mobile • Local Liberians • Processors predominantly smoke fish for local consumption	• Regulated open access • Local fishing associations focus on equitable access to fish and safety at sea • Separate fishing associations and sea chief for artisanal/ semi-industrial • West Africa Regional Fisheries Program (WARFP) is in the process of setting up a CMA in Robertsport with plans to implement a Territorial Use Rights in Fisheries (TURF)	Small dugout canoes with paddles or sails  *Photo credit:* Paul Donovan.
Semi-industrial (Fanti)	• Primarily small pelagics • Shallow and deep-water demersal • Sailfish • Shark	• Large ring nets • Gillnets • Hand lines	• Highly seasonal • Highly mobile (migrate entire coastline) • Harvesters of Ghanaian ancestry • Processors predominantly smoke fish for local consumption		Large planked canoes with outboard engines  *Photo credit:* Varasca, Panoramio.

FIGURE C.3. SUMMARY OF LIBERIA CASE STUDY OUTPUT AND INPUT SCORES

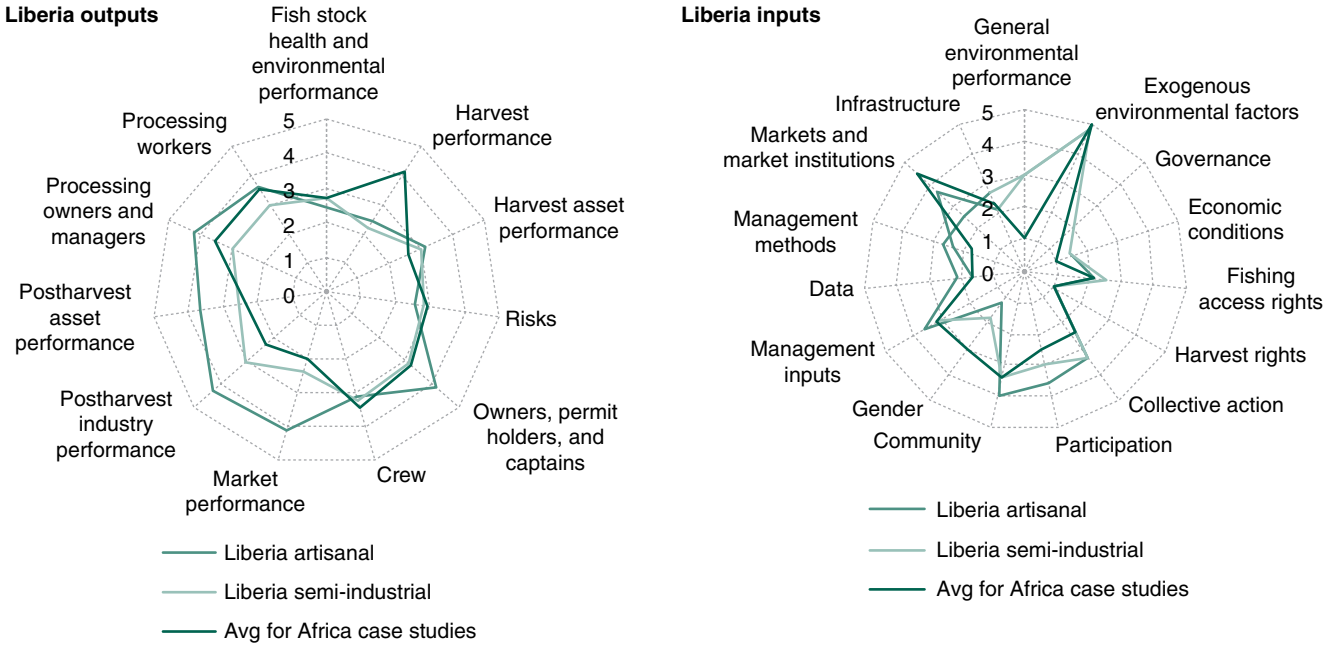
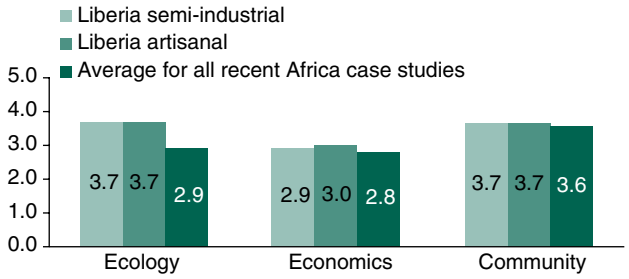


FIGURE C.4. ECOLOGY, ECONOMICS, AND COMMUNITY SUSTAINABILITY FOR LIBERIA ARTISANAL FISHERY



RELATIVE STRENGTHS

Ecological indicators are above average.

- Due to the implementation of a trawler spotter program, local experts consider the fish stock to be healthy as overfishing declines. There are few bycatch issues.
- Recent efforts have led to a reduction in the number of industrial vessels and less illegal activity inside the Inshore Exclusion Zone (IEZ). Fishermen report that this has increased fish stocks and landings.

Community indicators are slightly above average.

- Relative to their local communities, participants in the fishery are earning good livelihoods.
- The semi-industrial fishery is predominantly people of Ghanaian ancestry who have been living in the local community for extended periods, but there are also a larger number of migratory harvesters in this fishery.
- Although there is a level of mistrust and occasional conflict between the two fleets, there is frequent cooperation between artisanal and semi-industrial harvesters (information sharing about fish location and spatial rules that regulate harvest technology).

RELATIVE WEAKNESSES

Economic indicators are only slightly above average.

- Prices are reported to be generally increasing but show large seasonal variation due to changing availability of fish, which exposes the postharvest sector to market risk.
- There is very little harvest that goes to international markets.
- The landings pricing system is not competitive—there are a large number of first buyers/fishmongers but harvesters tend to sell only to one buyer (often their wives) and frequently have credit relationships with the buyer. It is difficult to gain access to other credit.
- First buyers tend to try to associate both to influence prices and to exclude outside competition, as securing supplies is an important factor.
- Harvest safety is an important concern, particularly in the artisanal fishery.

Rights inputs are below average.

- The tradition of regulated open access and highly migratory harvesters mean that establishing TURF boundaries and setting up RBM may be difficult.
- Infrastructure, expenditure on management, and participation in comanagement (days in stakeholder meetings and industry financial support) are all below average.

SIERRA LEONE

TABLE C.3. SUMMARY OF SIERRA LEONE ARTISANAL FISHERY IN TOMBO AND SHERBRO RIVER

Fishery Type	Species	Gear	Characteristics	Management	Vessels
Tombo Northern Yawri Bay	• Barracuda • Morlit • Herring (mainly Tombo) • Tarpon (mainly Bonthe) • Grouper • Lady • Spanish • Cowreh • Bonga (mainly Bonthe) • Gwangwa (also known as yellow croaker-sold to Korean businesses for export) • Shark (most common in Bonthe)	• Drift net • Pin chain • Clamp chain • Beach seine • Morel or hook and line • Lego chain • Channel fishing • Ghana/ Reggae fishing • Fencing	• Close to urban Freetown area; improved market for catch, alternative livelihoods, and infrastructure • Significant proportion of catch is sold fresh	• Little management from central or local government and weak traditional authorities. • Monitoring and enforcement is extremely limited.	Predominantly small canoes paddled by 1-5 fishermen.  *Photo credit:* EJF.
Sherbro River Estuary			• Remote area with poor links to larger urban markets, and less access to health/ education • Processors predominantly smoke fish for local markets or sell frozen to foreigners.	• Strong traditional authorities enforce basic local rules. • Advocacy for better practices undertaken by the NGO Environmental Justice Foundation.	Mainly propelled by outboard motors and used by 5-10 fishermen.  *Photo credit:* Kris, Flickr.

FIGURE C.5. SUMMARY OF SIERRA LEONE CASE STUDY OUTPUT AND INPUT SCORES

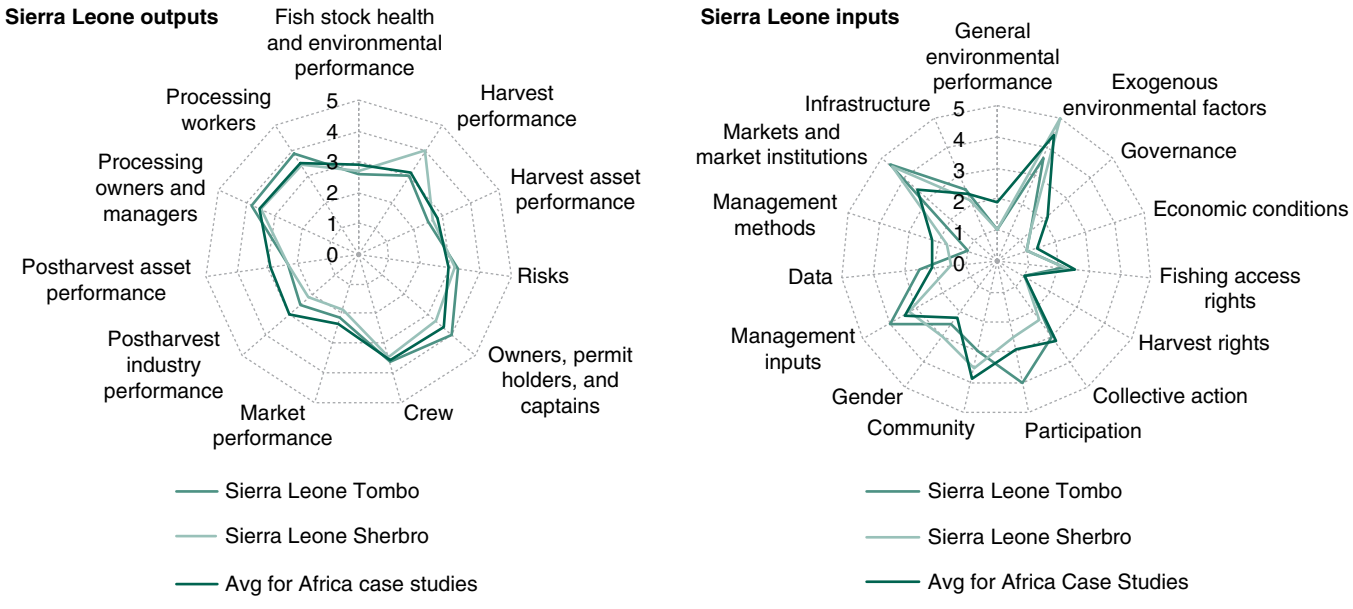
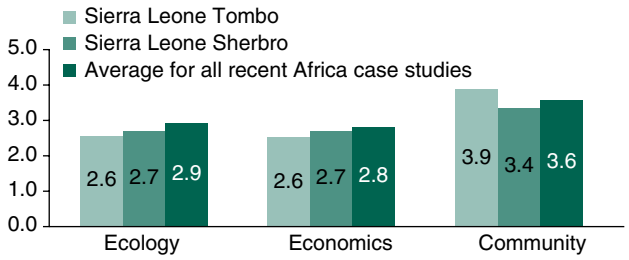


FIGURE C.6. ECOLOGY, ECONOMICS, AND COMMUNITY SUSTAINABILITY FOR SIERRA LEONE ARTISANAL FISHERY



RELATIVE STRENGTHS

Community indicators are above average in Tombo.

- There is wealth accumulating in the harvesting sector (primarily with captains) and in the processing sector.
- The presence of relatively sophisticated and expensive large "Ghana Boats" in the Tombo area means that many boat owners have significant capital investments and earn well above the regional average.
- There is evidence of social cohesion, strong leadership, and industry financial support for management.
- Price volatility is relatively low, which means that harvesters are shielded from some market risk.
- In Tombo, international trade with Liberia and Korea is facilitated by relatively sophisticated infrastructure and access to ice.

RELATIVE WEAKNESSES

Ecological indicators are below average.

- Years of overfishing and the use of illegal gear (monofilament nets, channel fishing, fishing in breeding grounds) have led to declining stocks and landings in recent years.
- There are issues with selectivity/bycatch.
- The critical habitat is affected by mangrove deforestation, coastal erosion, zakam mining, agricultural activities, and salt mining.
- Pollution from oil spills and urban runoff has been an issue in recent years.

Economic indicators are below average.

- In Tombo, total revenue is falling, total landings are very low, and the season length is short.
- The processing industry does not meet the hygiene or sustainability standards that would allow export to the EU or the United States.

Community indicators are below average in Sherbro.

- There are issues with harvest safety.
- Earnings in the harvesting and processing sector are below regional averages.

Access and harvest right inputs are below average. In Sherbro, traditional authorities play a large role and rights are slightly more exclusive and stable than in Tombo.

SENEGAL

TABLE C.4. SUMMARY OF SENEGAL ARTISANAL FISHERY IN NGAPAROU

Fishery Type	Species	Gear	Characteristics	Management	Vessels
Ngaparou	• Lobster • Grouper • Sea bream • Pandora • Sardinella • Horse mackerel • Crayfish	• Bottom set net • Small drift net • Hook and line • Drag net • Drift gillnet • Ring net	• Boat owners seldom fish and instead hire contract crews • Crew is paid based on share system • Long experience with traditional management • Some fish harvested for export markets • One-year renewable license required to fish in protected area	• Local fishermen committees have been given formal comanagement powers • Spatial management with an MPA, buffer zone, and regulated fishing area • No limit on the number of licenses	Dugout 25 m canoes and planked boats  *Photo credit:* Lance Dietrich.

FIGURE C.7. SUMMARY OF SENEGAL CASE STUDY OUTPUT AND INPUT SCORES

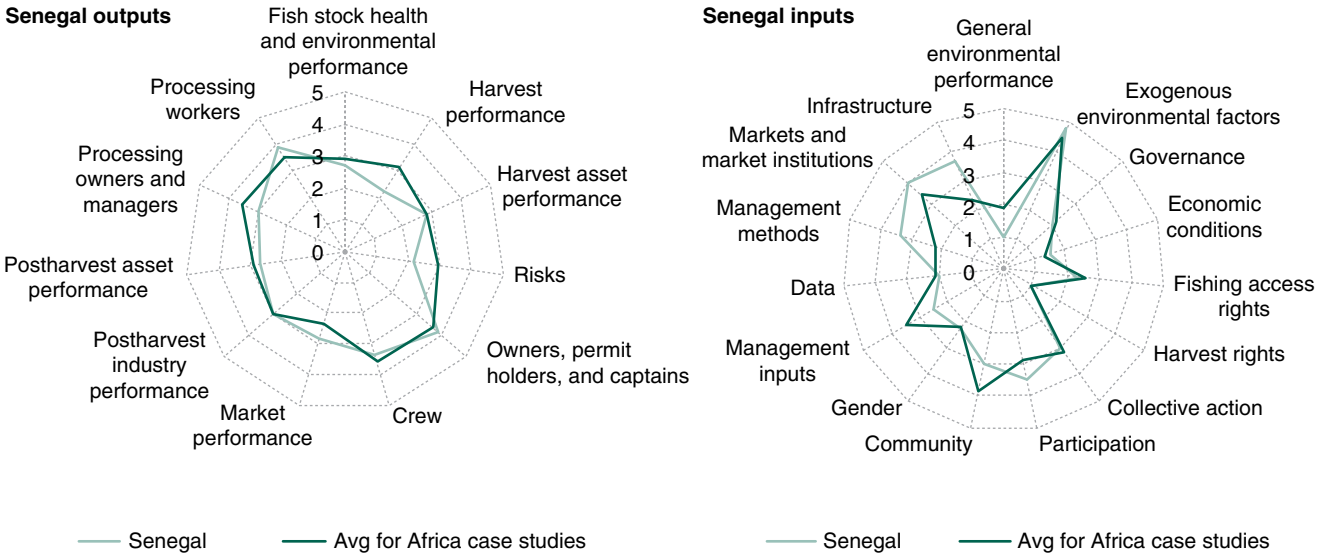
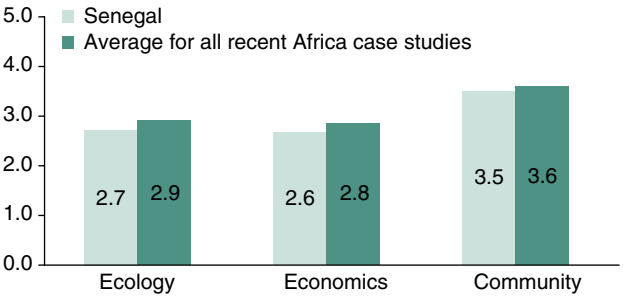


FIGURE C.8. ECOLOGY, ECONOMICS, AND COMMUNITY SUSTAINABILITY FOR SENEGAL ARTISANAL FISHERY



RELATIVE STRENGTHS

» Wealth appears to be accumulating in the harvest sector, particularly among captains who are more likely to be residents of local communities than are their crew.

» Income in fisheries is generally higher than in other rural occupations.

Management methods and data collection are slightly above average for the other case studies.

» There is a marine protected area where the management has had some success at limiting fishing effort.

Participation in stakeholder meetings and industry financial support for management are very high.

- Harvesters pay a fuel tax that is used for fisheries surveillance and monitoring.

The processing sector has the capacity to export to the EU.

- Some processors appear to be efficient and modernized and have large ex-vessel to wholesale margins.
- The infrastructure is relatively good as Ngaparou is not far from Dakar, there is an ice-making facility in town, and fishermen have access to modern technology.

RELATIVE WEAKNESSES

Ecological indicators are below average.

- Almost all stocks are overfished.
- There is a high level of illegal and unreported landings.
- Monofilament net is forbidden but fishermen are using it.
- There is an incursion of fishermen from other communities into the protected area.
- Trawlers fishing with explosives have degraded the critical environment.

The government provides subsidies for fuel, gear, and vessels that further incentivize overfishing.

Harvest safety is an issue as there are several accidents and deaths each year.

Limited support from the Department of Fisheries may weaken capacity of Beach Village Committees (BVCs) to enforce resource regulations.

- Local committees have not been effective at limiting access to the fish resources.

MALAWI

TABLE C.5. SUMMARY OF MALAWI ARTISANAL FISHERY IN LAKE CHIUTA

Fishery Type	Species	Gear	Characteristics	Management	Vessels
Lake Chiuta	Pelagics and semi-pelagics: • Makumba • Tilapia • Mlamba • Matemba • Chitondolo • Mphuta	• Gill net • Fish traps • Hook and line	• Fish year-round but peak season is during rainy season (December-February) • This is a remote fishery that relies on sun-drying or smoking for fish to reach distant markets, including those located in urban centers	• The local fishing association and BVCs formulate and enforce management • On the Malawian side of the lake, there is a combination of restrictions on the use of gear and regulated permits. • On the Mozambican side, it is open access	Dugout canoes and a few planked boats   *Photo credit:* Friday Njaya.

FIGURE C.9. SUMMARY OF MALAWI CASE STUDY OUTPUT AND INPUT SCORES

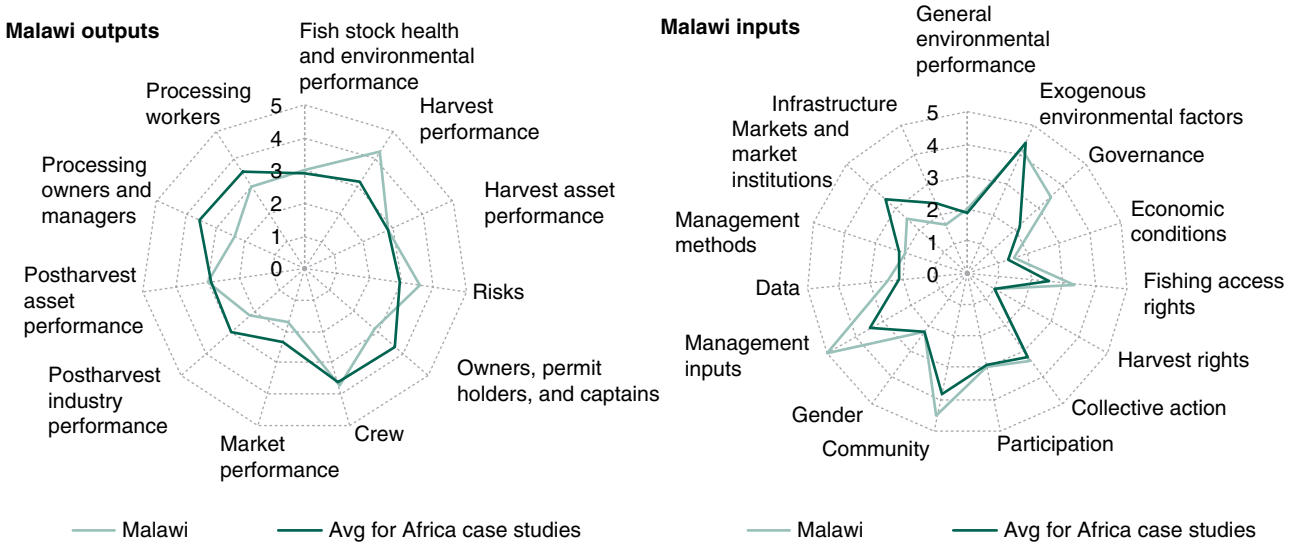
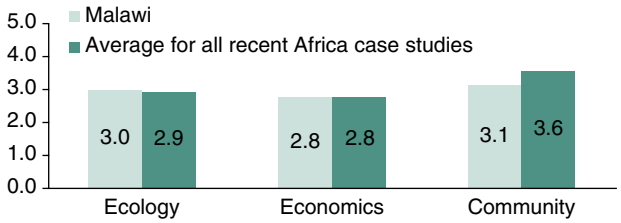


FIGURE C.10. ECOLOGY, ECONOMICS, AND COMMUNITY SUSTAINABILITY FOR MALAWI ARTISANAL FISHERY



RELATIVE STRENGTHS

Economic indicators are average

» Annual catches and total revenue are stable and there is no evidence of a shortened season due to excess capacity. This reduced volatility is largely due to the nature of a lake fishery.

» Price volatility is low, which means that harvesters are shielded from some market risk.

Ecological indicators are above average.

- Fish stocks do not appear to be overfished and there are few problems with bycatch.
- Illegal and unreported landings are not a serious issue as there are no foreign trawlers, only intrusion from the unregulated Mozambican side of the lake.

Harvest safety is very high compared with marine fisheries.

Harvest rights are above average.

- The local BVC does not allow harvesters owning illegal gear (such as mosquito nets) or those who are not members to access the fishery.
- They have been very effective at enforcing the ban on nkacha nets on the Malawi side.
- There is strong evidence of social cohesion and leadership within the fishery.

RELATIVE WEAKNESSES

Community indicators are below average.

- Earnings, educational attainment, and access to health care are below national averages in the harvesting sector, particularly for captains.
- Within the processing sector, wages are also below national averages.
- The rural location of the fishery means that higher education and health care are less likely to be accessible to the children of harvesters and processors.

There is no capacity for export in the processing industry.

- Because of the remote nature of the fishery, infrastructure and technology are very poor.
- There are no fillets or improved products; all fish is immediately smoked.
- Regional support businesses are almost nonexistent and processing yield is low.

Seining operations (predominantly originating from Mozambique) are a threat to stock levels and biodiversity.

Limited support from the Department of Fisheries may weaken capacity of BVCs to enforce resource regulations.

ENVIRONMENT AND NATURAL RESOURCES GLOBAL PRACTICE POLICY NOTE

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