AGRICULTURE AND RURAL DEVELOPMENT DISCUSSION PAPER 52

EVALUATION OF NEW FISHERY PERFORMANCE INDICATORS (FPIs):

A Case Study of the Blue Swimming Crab Fisheries in Indonesia and Philippines

THE WORLD BANK

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ACRONYMS AND ABBREVIATIONS

AFTEN	Africa Environment and Natural Resource Management, the World Bank Group
APRI	Asosiasi Pengelolaan Rajungan Indonesia (Indonesia Blue Swimming Crab Processing Association)
ARD	Agriculture and Rural Development Department, the World Bank Group
ATC	Airtight container
BFAR	Department of Agriculture–Bureau of Fisheries and Aquatic Resources, the Philippines
BSC	Blue Swimming Crab
CPUE	Catch per Unit of Effort
EASER	East Asia-Social, Environment, and Rural
EPI	Environmental Performance Index
FAO	Food and Agriculture Organization of the United Nations
FIP	Fisheries Improvement Project
FPIs	Fishery Performance Indicators
JICA	Japan International Cooperation Agency
ICFA	International Coalition of Fisheries Associations
IEF	Index of Economic Freedom
ITQ	Individual Transferable Quota
LGU	Local Government Unit
MEY	Maximum Economic Yield
MMAF	Ministry of Marine Affairs and Fisheries, Indonesia
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NFI	National Fisheries Institute
NMFS	National Marine Fisheries Services
NIACDEV	Northern Iloilo Alliance for Community Development
PROFISH	Global Program on Fisheries, the World Bank Group
SFP	Sustainable Fisheries Partnership
WGI	Worldwide Governance Indicators

EXECUTIVE SUMMARY

Currently, the World Bank has about $600 million invested in its fishery-related portfolio. It is anticipated that the commitment to fisheries and aquaculture will increase considerably in the next few years. However, the task team leaders have been struggling to identify an adequate monitoring and evaluation tool. None of the proposed indicators capture the full effectiveness of fishery management, and none help the decision makers understand causal links. Some indicators primarily focus on ecological sustainability, such as measuring the status of fish stock, while others narrowly focus on the economic aspects, such as net economic benefit or fishery revenue. Additionally, the cost of collecting detailed biological or economic data can be prohibitive or simply not feasible in some developing countries.

There is an urgent need to develop indicators that can measure the success of fisheries management systems in achieving the "triple bottom line" of environmental, economic, and social sustainability. The measurement approach should also help decision makers understand the linkage between success and management inputs, infrastructure, enforcement, the marketing system, and exogenous factors. Furthermore, the indicators must be relevant, accurate, quantifiable, understandable, replicable, comparable between developed and developing regions, and readily available using current expertise and data.

The new Fishery Performance Indicators (FPIs) aspire to meet these conditions (Anderson and Anderson 2010). The FPIs are a new set of indicators for evaluating and comparing the world's fisheries management systems based on their success in being *ecologically sustainable, socially acceptable, community enriching, and generating sustainable resource rents or profits.* The FPIs fall into two categories. The first category is indicators of *outputs* that identify and measure key factors that reflect success or failure in achieving the triple bottom line from fisheries. The second consists of *input* factors that enable or contribute to the process of developing sustainable and wealth-creating fisheries. FPIs are designed to be clearly defined and easy to apply for a knowledgeable expert. The FPIs are intended to be completed within days. This rapid assessment approach can give a clear picture of the ecological, social, and economic situation associated with the fisheries management system.

The objectives of this report are to:

a. Field-test the FPIs as an evaluation tool for the Philippine and Indonesian blue swimming crab fisheries.
b. Compare the results with those for the Icelandic lobster fishery. This provides an aspirational target for improvement as well as an additional test of the FPIs.
c. Evaluate the limitations and strengths in FPIs based on the application above; feedback of the workshop conducted in May 2011; and input from over 30 researchers, government agencies, the private sector, and nongovernmental organizations (NGOs) from around the world. Special attention is given to application in data-poor situations.
d. Provide explicit revisions to the FPIs based on (c) as a final step prior to broader application.

The results of the field test indicate that the FPIs represent a useful and powerful tool for fishery project monitoring and evaluation. The experience indicates that application in the Philippines, Indonesia, and Iceland can be completed in about 2 weeks at relatively low cost. 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. Notably, the indicators capture key features of success:

- Fish Stock Health and Environmental Performance
- Harvest Performance Efficiency
- Harvest Asset Performance (Vessels, etc.)

- Risk Exposure
- Conditions Facing Owners, Permit Holders, and Captains
- Conditions Facing the Crew
- Market Performance
- Processing and Support Industry Performance
- Post-Harvest Asset Performance (Processing Plants, etc.)
- Conditions Facing Processing Owners and Managers
- Conditions Facing Processing Workers

The indicators also capture essential features of the enabling input factors:

- General Environmental Conditions
- Exogenous Environmental Factors (especially pollution and climate change–related factors)
- National Governance Conditions
- National Economic Conditions
- Characteristics of Fishing Access Rights
- Characteristics of Fishing Harvest Rights
- Participation in Co-Management
- Management Inputs (e.g., expenditure and enforcement)
- Data Collection and Analysis
- Participation by Stakeholders
- Markets and Market Institutions
- Infrastructure

Although the application of the FPIs and the feedback from the research workshop in May 2011 was very positive, there were several improvements to the scaling of the indicators and a few omissions that need to be revised for scaled-up application. The suggested revisions in the scaling are identified in the text, and some specific recommendation for additions are found in Appendix B.

Overall, once the revisions have been incorporated the FPIs are ready to be scaled up as a tool for all the fishery projects in the World Bank, as a management assessment tool or a tool to evaluate investment opportunity. A detailed FPI assessment for each targeted country will assist management decisions for all the target fishery projects regardless of their implementation status. For projects that are in the planning stage, the output will help identify the strengths and weaknesses of the fisheries and thus enable the identification of evidence-based policy suggestions. For projects under implementation, the output will help measure their effectiveness in improving fishery performance.

The Bank is moving to enhance its activity related to the oceans, and the FPIs will have great value in identifying key target fisheries and measuring progress. At maturity, the FPIs could be implemented and accessed via a dashboard containing hundreds of fisheries, with data collected at regular intervals to monitor sustainable wealth-creating fisheries within and across management systems. The idea, logic, and design of the indicators can help develop a broadened set of indicators that can be applied to codependent fishery-aquaculture and aquaculture management systems.

Above all, the impact of these indicators is potentially transformative. They will be effective levers to promote change but also suggest what changes should be made to result in sustainable improvement in the fishery, the economic conditions, and community status.

Chapter 1: INTRODUCTION

1.1 BACKGROUND

In 2005, the World Bank formally reengaged in the fisheries sector, with the establishment of a multidonor trust fund, Global Program on Fisheries (PROFISH), to provide seed capital for a new portfolio of investments that would focus on assisting countries to reform fisheries governance. Over the subsequent years, a number of new investments were launched with PROFISH's support, particularly in Africa and East Asia. Currently, the Bank's portfolio related to fisheries has grown to over $600 million and is expected to continue to grow rapidly.

Building on these experiences and continued interest from the global community, in 2011 the World Bank launched a Strategy Vision for Fisheries and Aquaculture articulated by PROFISH to guide further implementation of these investments and expanded support for fisheries governance reforms and sustainable fisheries and aquaculture management in client countries (PROFISH 2011). Following this, a note on the application of this strategy to the Africa region was developed to meet the demand of the growing portfolio in the region (AFTEN 2011).

There is a strong need for the Bank and its partners to take a global view of the success of these investments. For this reason, the Bank has supported work to define a global set of Fishery Performance Indicators (FPIs). The goal is to develop indicators that can measure the success of fisheries management systems in achieving the "triple bottom line" of environmental, economic, and social sustainability—a set of core indicators that can be applied across a diverse set of fisheries to evaluate and monitor the performance. The measurement approach should also help decision makers understand the linkage between success and management inputs, infrastructure, enforcement, the marketing system, and exogenous factors. Furthermore, the indicators must be relevant, accurate, quantifiable, understandable, replicable, comparable between developed and developing regions, and readily available using current expertise and data.

The new FPIs aspire to meet these conditions (Anderson and Anderson 2010). The FPIs are a new set of indicators for evaluating and comparing the world's fisheries management systems based on their success in being *ecologically sustainable, socially acceptable, community enriching,* and *generating sustainable resource rents or profits.* This triple bottom line measurement metrics ensure the fishery management system is not biased toward one aspect and neglects the other as these three dimensions are critical for achieve long-term sustainability. The FPIs integrate ecological, social, and economic dimensions to measure the output of the fisheries (identifying where wealth accumulates within the value chain) and input factors (assessing the levels of factors contributing to the sustainable wealth creation). They are designed not only as a basic measurement tool, but also as a framework for identifying what policies and interventions are likely to have the greatest impact. This work was originally supported by ALLFISH (a public private partnership initiative the World Bank established and that is managed by the International Coalition of Fisheries Associations-ICFA).

1.2 PURPOSE OF THE STUDY

To further develop and finalize the FPIs for scaling up to the Bank's entire fisheries portfolio, a number of specific pilots and case studies have been conducted. This report provides an overview of the FPIs, and a summary of two case studies in its application, the blue swimming crab (BSC) fisheries in Indonesia and the Philippines. A comparative analysis with an Icelandic lobster fishery is conducted as a benchmark, as the Icelandic lobster fishery is also export oriented and has been recognized as a well-managed fishery.

The objective of this study is to:

- Field-test the application of FPIs for the Philippine and Indonesian blue swimming crab fisheries to evaluate the applicability of the FPIs for developing countries in order to finalize the FPIs for scaling up.
- Compare the results with results for the Icelandic lobster fishery. This provides an aspirational target for improvement as well as providing an additional test of the FPIs.

- Evaluate the limitations and strengths in FPIs, based on the application above, feedback of the workshop conducted in May 2011, and input from over 30 researchers, government agencies, the private sector, and NGOs from around the world. Special attention is given to application in data-poor situations.
- Provide explicit revisions to the FPIs based on the above step as a final step prior to broader application.

An additional benefit, but not the central goal of this study, is to provide useful information for conservation and management of the blue swimming crab fisheries in these two countries by identifying the strengths and weaknesses of current fishery management in terms of wealth generation as reflected in economic, environmental, and community conditions.

1.3 STRUCTURE OF THE STUDY

The study is organized as follows:

Chapter 2 provides a brief introduction of Fishery Performance Indicators (FPIs) and the blue swimming fisheries in Indonesia and the Philippines.

Chapter 3 presents the results for FPIs that measure the success ("Outputs") in achieving the "triple bottom line" of environmental, social, and economic sustainability and provides a critical evaluation of strengths, weaknesses, and omissions of the current FPIs design.

Chapter 4 presents the results for FPIs that measure factors ("Inputs") that enable (or undermine) the likelihood that the triple bottom line will be achieved and provides a critical evaluation of strengths, weaknesses, and omissions of the current FPIs design.

Chapter 5 summarizes the results and draws conclusions about the applicability of FPIs and next steps.

Five appendices provide supplementary information. Appendix A provides detailed explanation of the rationale and measurement for each indicator. Appendix B lists additional suggested indicators based on the case studies. Appendix C lists the participants who have attended the workshops in London and Hawaii. Appendixes D and E illustrate the FPIs' output and input results for the studied fisheries, respectively.

Chapter 2: OVERVIEW OF FPIs AND STUDIED FISHERIES

2.1 FISHERY PERFORMANCE INDICATORS (FPIs)

Fishery Performance Indicators (FPIs) make up a multidimensional index used to provide a rapid assessment of the successes and failures of a particular fishery and management system with regard to sustainable wealth generation (Anderson and Anderson 2010). The rationale behind the FPI is that a fisheries ecological sustainability is a necessary but not sufficient condition to ensure the maximum economic yield. The FPIs are designed to evaluate and compare the world's fisheries management systems based on their success in being *ecologically sustainable, socially acceptable, community enriching,* and *generating sustainable resource rents or profits.* This triple-bottom measurement metrics ensures the fishery management system is not biased toward one aspect and neglects the others as all three dimensions are critical to achieve long-term sustainability.

The FPIs fall into two categories. The first category is indicators of *outputs* that identify and measure key factors that reflect success or failure in achieving the triple bottom line from the fisheries. The second consists of *input* factors that enable or contribute to the process of developing sustainable wealth-creating fisheries. FPIs are designed to be clearly defined and easy to apply for a knowledgeable expert. The FPIs are intended to be completed within days. This rapid assessment approach can give a clear picture about the ecological, social, and economic situations associated with the fisheries management system.

There are 62 *output* indicators that capture key features of success (table 2.1), including the following:

- Fish Stock Health and Environmental Performance
- Harvest Performance Efficiency
- Harvest Asset Performance (Vessels, etc.)
- Risk Exposure
- Conditions Facing Owners, Permit Holders, and Captains
- Conditions Facing the Crew
- Market Performance
- Processing and Support Industry Performance
- Post-Harvest Asset Performance (Processing Plants, etc.)
- Conditions Facing Processing Owners and Managers
- Conditions Facing Processing Workers

There are 46 *input* factors that enable (or undermine) the success of a fishery to achieve the triple bottom line (table 2.2), including the following:

- General Environmental Conditions
- Exogenous Environmental Factors (especially pollution and climate change–related factors)
- National Governance Conditions
- National Economic Conditions
- Characteristics of Fishing Access Rights
- Characteristics of Fishing Harvest Rights
- Participation in Comanagement
- Management Inputs (e.g., expenditure and enforcement)
- Data Collection and Analysis
- Participation by Stakeholders
- Markets and Market Institutions
- Infrastructure

All of the indicators are coded in a five-point scale, with the bins generally chosen to reflect the quintiles of performance on the metric globally. Output indicators scored below 3.5 have substantial room for improvement. Output indicators scored below 2 (in the bottom two quintiles) are considered to require urgent attention. Input factors are not necessarily monotonic (a higher score is not necessarily better).

A few distinguished features of FPIs include the following: FPIs integrate governance, economic, and social dimensions with ecological measurements to evaluate a fishery at a given point in time; FPIs evaluate the whole value chain, not

TABLE 2.1: Prototype Fishery Performance Indicators—Outputs (Measuring Success)

COMPONENT	DIMENSION	MEASURE	CATEGORY
Ecologically Sustainable Fisheries	Fish Stock Health and Environmental Performance	Proportion of Harvest with a Third-Party Certification	Ecology
		Fish Stock Sustainability Index (NMFS)	Ecology
		Percentage of Stocks Overfished	Ecology
		Nonlandings Mortality	Ecology
Harvest Sector Performance	Harvest Performance	Landings Level	Economics
		Excess Capacity	Economics
		Season Length	Economics
	Harvest Asset Performance	Ratio of Asset Value to Gross Earnings	Economics
		Total Revenue versus Historic High	Economics
		Asset (Permit, Quota) Value versus Historic High	Economics
		Borrowing Rate Relative to Risk-Free Rate	Economics
		Source of Capital	Economics
		Functionality of Harvest Capital	Economics
	Risk	Annual Total Revenue Volatility	Economics
		Annual Landings Volatility	Economics
		Intra-annual Landings Volatility	Economics
		Annual Price Volatility	Economics
		Intra-annual Price Volatility	Economics
		Spatial Price Volatility	Economics
		Contestability and Legal Challenges	Community
	Owners, Permit Holders, and Captains	Earnings Compared to National Average Earnings	Community
		Fishery Wages Compared to Nonfishery Wages	Community
		Education Access	Community
		Access to Health Care	Community
		Social Standing of Boat Owners and Permit Holders	Community
		Proportion of Nonresident Employment	Community
	Crew	Earnings Compared to National Average Earnings	Community
		Fishery Wages Compared to Nonfishery Wages	Community
		Education Access	Community
		Access to Health Care	Community
		Social Standing of Crew	Community
		Proportion of Nonresident Employment	Community
		Crew Experience	Community
		Age Structure of Harvesters	Community
Post-Harvest Performance	Market Performance	Ex-Vessel Price versus Historic High	Economics
		Final Market Use	Economics
		International Trade	Economics
		Final Market Wealth	Economics
		Wholesale Price Relative to Similar Products	Economics
		Capacity of Firms to Export to the United States and European Union	Economics
		Ex-Vessel to Wholesale Marketing Margins	Economics

(*Continued*)

TABLE 2.1: Prototype Fishery Performance Indicators—Outputs (Measuring Success) (*Continued*)

COMPONENT	DIMENSION	MEASURE	CATEGORY
	Processing and Support Industry Performance	Yield of Processed Product	Economics
		Capacity Utilization Rate	Economics
		Product Improvement	Economics
		Regional Support Businesses	Economics
		Time to Repair	Economics
	Post-Harvest Asset Performance	Borrowing Rate Relative to Risk-Free Rate	Economics
		Source of Capital	Economics
		Age of Facilities	Economics
	Processing Owners and Managers	Earnings Compared to National Average Earnings	Community
		Manager Wages Compared to Nonfishery Wages	Community
		Education Access	Community
		Access to Health Care	Community
		Social Standing of Processing Managers	Community
		Nonresident Ownership of Processing Capacity	Community
	Processing Workers	Earnings Compared to National Average Earnings	Community
		Worker Wages Compared to Nonfishery Wages	Community
		Education Access	Community
		Access to Health Care	Community
		Social Standing of Processing Workers	Community
		Proportion of Nonresident Employment	Community
		Worker Experience	Community

Source: Anderson and Anderson, 2010, as revised based on comments received at the May 2011 workshop.

TABLE 2.2: Prototype Fishery Performance Indicators—Inputs (Enabling Factors)

COMPONENT	DIMENSION	MEASURE
Macro Factors	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 (A)
		Level of Chronic Pollution (B)
	Governance	Governance Indicator—Effectiveness
		Governance Indicator—Voice and Accountability
	Economic Condition	Index of Economic Freedom
		Gross Domestic Product (GDP) Per Capita
Property Rights and Responsibility	Access	Proportion of Harvest Managed Under Limited Access
		Transferability Index
		Security Index
		Durability Index
		Flexibility Index
		Exclusivity Index

(*Continued*)

TABLE 2.2: Prototype Fishery Performance Indicators—Inputs (Enabling Factors) (*Continued*)

COMPONENT	DIMENSION	MEASURE
	Harvest	Proportion of Harvest Managed with Rights-Based Management
		Transferability Index
		Security Index
		Durability Index
		Flexibility Index
		Exclusivity Index
	Collective Action	Participation in Harvester Organizations
		Harvester Organization Influence on Fishery Management and Access
		Harvester Organization Influence on Business and Marketing
Management	Inputs	Management Expenditure to Value of Harvest
		Management Employees to Value of Harvest
		Management Employees per Permit Holder
		Research as a Proportion of Fisheries Management Budget
		Level of Subsidies
	Data	Data Availability
		Data Analysis
	Participation	Days in Stakeholder Meetings
		Industry Financial Support for Management
Post-Harvest	Markets and Market Institutions	Landings Pricing System
		Availability of Ex-Vessel Price and Quantity Information
		Number of Buyers
		Degree of Vertical Integration
		Level of Tariffs
		Level of Nontariff Barriers
	Infrastructure	International Shipping Service
		Road Quality Index
		Technology Adoption
		Extension Service
		Reliability of Utilities/Electricity
		Access to Ice and Refrigeration

Source: Anderson and Anderson, 2010, as revised based on comments received at the May 2011 workshop.

only the harvest sector, but also the post-harvest sector; with the separation between output result and input factors, FPIs have the potential to provide solid quantitative proof to identify the most influencing factors for performance improvement. This can give a clear direction for policy change and intervention to obtain the most effective results.

Anderson and Anderson (2010) developed a detailed manual to explain each indicator (see Appendix A). A user-friendly Excel spreadsheet is designed for local experts to fill out easily with summarized results and graphs. FPIs are designed to be easy to collect and score across a wide range of fisheries. They do not generally require detailed data. They are quantifiable, understandable, accurate, and feasible.

The case studies in Indonesia and the Philippines for blue swimming crab fisheries are the first to be applied FPIs in the developing countries.[1]

1 Recently, FPIs have been applied to Bangladesh inland fisheries, Uganda Nile Perch fisheries, Uganda tilapia fishery, Uganda dagaa fishery, Seychelles artisanal and semi-industrial fisheries, Seychelles sea cucumber and lobster fisheries, Ghana artisanal fishery, Peruvian anchovy fishery, and Vietnam coastal fishery in Thanh Hoa.

TABLE 2.3: Questions FPIs Attempt to Answer

CATEGORY	QUESTIONS
Outputs Indicators (Measuring Success)	1. What is the fish stock status (Percentage of stocks overfished, third-party certification)? 2. What is the harvest sector status (landing level, excess capacity)? 3. How is the harvest sector asset performing (source of capital, borrowing rate, asset value trend)? 4. What are the risks this industry is facing (price, trade, legal, environmental)? 5. What is the status of boat owners/captain (income level, social standing, and proportion of nonresident employment)? 6. What is the status of the crew (income level, social standing, proportion of nonresident employment)? 7. What is the market performance (final market, capacity of firms to export, market margins)? 8. What is the processing industry (yield rate, capacity utilization rate, product improvement, source of capital, borrowing rate)? 9. What is the status of processing facility owners (income level, social standing, and proportion of nonresident employment)? 10. What is the status of processing workers (income level, social standing, proportion of nonresident employment, child labor issue)?
Input Factors (Enabling)	1. What is the general macro environment (EPI, governance indicator, GDP per capita, index of economic freedom)? 2. What is the level of the environmental risks (pollution, tsunami, hurricane)? 3. Are property/tenure rights in place and how are they defined (security, durability, flexibility, exclusivity)? 4. To what degree can stakeholders participate in the management process (comanagement/corporate management system setup, role of industry organizations)? 5. What are the levels of subsidies? 6. Are the data on fisheries sectors collected and decisions being made based on data analysis? 7. What is the business environment (time to get permit, easiness to renew, cost of compliance, tax level)? 8. What are the market conditions (quality of the product, number of buyers/sellers, supply chain)? 9. What is the relative condition of the infrastructure (transportation, utility, ice supply)?

Source: Authors.

FPIs have value to many different users. For example, the development and aid agencies can use FPIs' assessment results to track the progress of the project and compare the performance before and after projects. The academic and research community can use FPIs to test different hypotheses regarding which factors have the most impact. Government and fishery managers can use FPIs to identify areas for improvement. Additionally, an assessment of FPIs for a fishery management system will help answer many critical questions, such as whether a fishery is sustainable, whether the property rights are well defined, and whether the market performance is acceptable. Table 2.3 lists more examples.

2.2 CASE STUDY FISHERIES

This section will give a brief overview of the studied fisheries: Blue Swimming Crab (BSC) (*Portunus pelagicus*) fisheries in Indonesia and the Philippines. The rapid development of BSC fisheries in these two countries is mainly driven by increasing demand in the international market, particularly in the United States. Swimming crabmeat was the second largest (by volume) imported crabmeat to the United States, after snow crab, contributing to 23 percent of total volume of crab imports in 2008 (25,652 MT) (NMFS 2010). The main BSC exporting countries are Indonesia (31 percent), China (24.7 percent), Thailand (13 percent), Vietnam (11 percent), and the Philippines (7.3 percent) (NMFS 2011).

The BSC fisheries in Indonesia and the Philippines are particularly interesting because these fisheries are a product of international trade and have attracted the interest of the private sector in maintaining the sustainability of these fisheries. The private sector, especially processors, traders, retail, and restaurants, is concerned about the health of the fishery because it will affect their business and profit. A National Fisheries Institute (NFI) Crab Council consisting of 12 U.S. importers was formed in 2009 to encourage and support sustainability management in crab-producing countries. They are supporting local fisheries associations to conduct stock assessment, capacity building, and fishermen training. In July 2011, their milestone action was to approve a supply-driven minimum size purchase policy targeting the phaseout of the use of undersized crabs in member company products and supporting science-based studies (NFI 2011). The latest initiative is to limit markets for berried female crabs and crab roe which went into effect on November 1, 2011 (Fishupdate 2011). This case study was done before the implementation of these policies, which provides a good baseline for the situation. In the future, applying FPIs again can measure the impact of these policies.

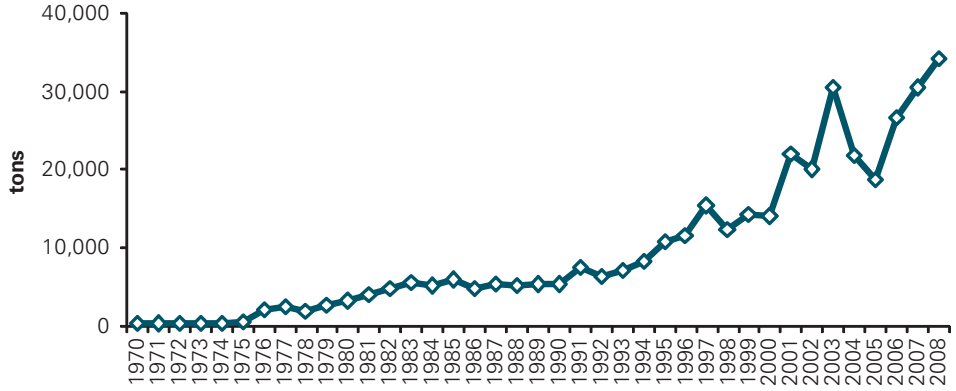
2.2.1 Indonesian Blue Swimming Crab (BSC) Fishery[2]

2.2.1.1 Landings

The Indonesian BSCs (*Portunus pelagicus*), locally known as *rajungan*, are distributed throughout the Indo-Pacific. The landing levels have experienced an uptrend over the past

2 This part is based on the report written by Dessy Anggraeni from Sustainable Fisheries Partnership (SFP).

FIGURE 2.1: Blue Swimming Crab Landings in Indonesia (1970–2008)



Source: FAO 2011.

40 years (figure 2.1). There was a significant drop during the period of 2004 and 2005, but levels soon recovered after 2005. In 2008, Indonesia harvested over 34,000 tons of BSCs, contributing to 20 percent of global BSC production and ranking as the second largest BSC-producing country right after China (FAO 2011).

BSCs in Indonesia generally live on sandy or on a combination of sand and mud bottoms, sand flats bordering grassy areas, and shallow brackish water to depths beyond 40 meters. They are fast growers. Female BSCs may reach sexual maturity at 98 mm while the males do at 87 mm (Sulistiono et al. 2009). In terms of landing areas, North Java has been the major catching area for BSCs in Indonesia, contributing to about 28 percent of total production in the period from 1990 to 2006, followed by East Sumatra (21 percent), South Sulawesi (21 percent), and Malacca Strait (14 percent) (figure 2.2).

2.2.1.2 Stakeholder Involvement in the Fishery

In the BSC fishery value chain, six stakeholder groups are involved, including fishermen, collectors/middlemen (bakul), miniplants/peelers, processors/exporters, distributors/central market, and retail/supermarkets/seafood restaurants (figure 2.3).

Crab fishing in Indonesia is mostly carried out by small-scale operators. About 65,000 fishermen directly relied on this fishery (SFP 2012). They use boats of less than 10 gross tonnes (GT) with or without motors (although in some cases fishermen do not use boats). The gear is primarily bottom gillnets and collapsible traps, and to a lesser extent, the now illegal shallow bottom trawls (baby trawls). There are two types of fishermen involved in BSC fisheries across Indonesia:

- Daily fishermen: They start fishing in the evening and land in the morning. They carry fuel for only one trip and use gillnet or collapsible traps. The operation area is nearby the coastline (onshore).
- *Babangan* fishermen: They usually sail in groups of three to five for 2 to 7 days. They carry enough fuel and supplies to reach distant fishing grounds. Crab traps are commonly used. Cooking facilities and ice are also available to boil and store BSCs on the boat.

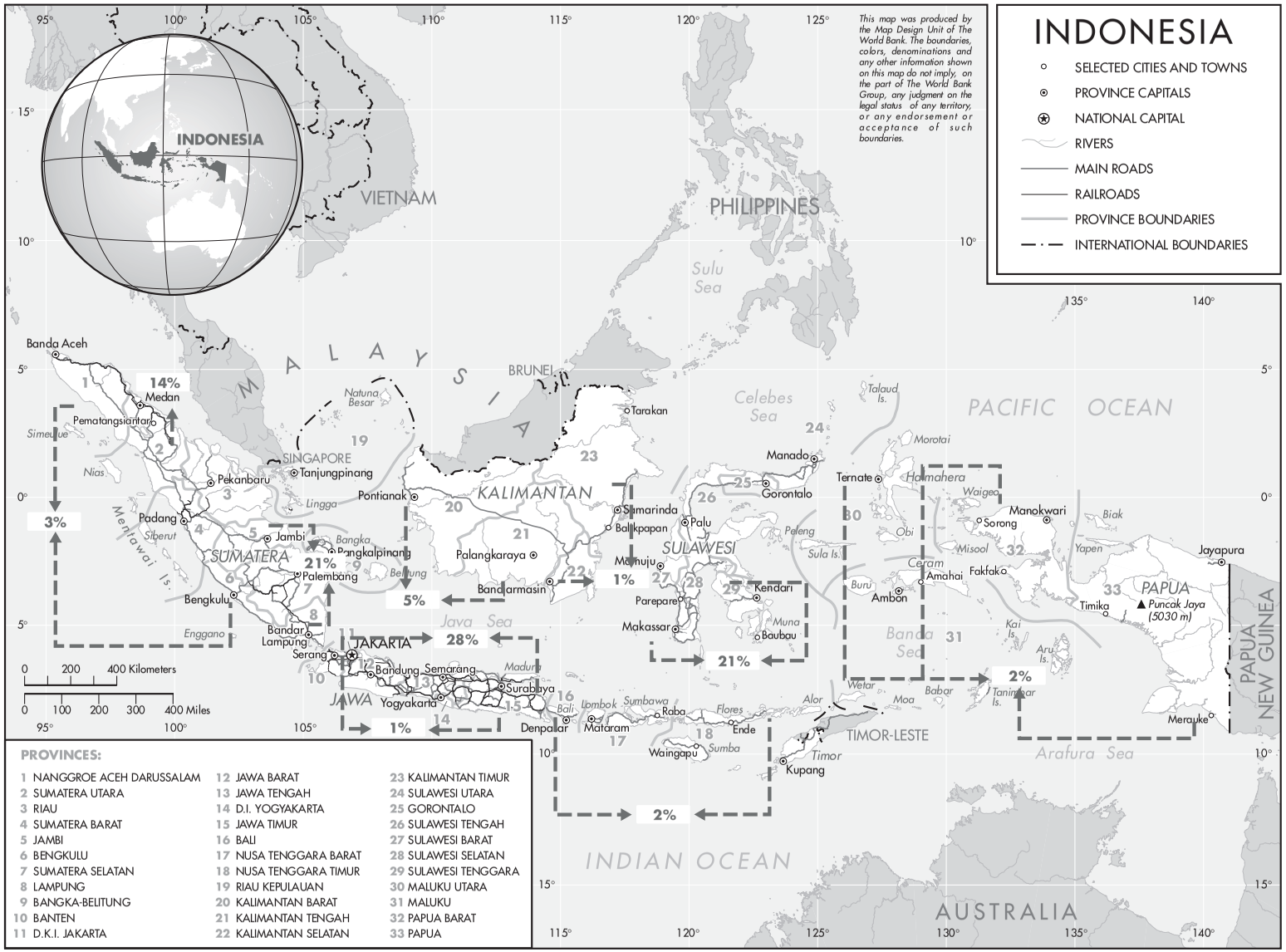
In addition, there are some 13,000 pickers working at hundreds of mini processing plants. Moreover, there are several thousand other direct stakeholders involved as middlemen, operators of the miniplants where initial processing is carried out, and the final processors/packagers who export the products. There are at least 28 crab processors and exporters operating in Indonesia.

2.2.1.3 Processing

Most BSCs caught are processed into frozen, canned, and pasteurized crabmeat in miniplants. In the past, miniplants (picking plants) normally got financial support from the processor/exporter to run the business. All the facility and equipment were supplied by a specific processor/exporter. In return, these miniplants have to supply to these processor/exporters. But, nowadays, most miniplants are independent, and they can sell their crabs to any processors/exporters if the prices permit.

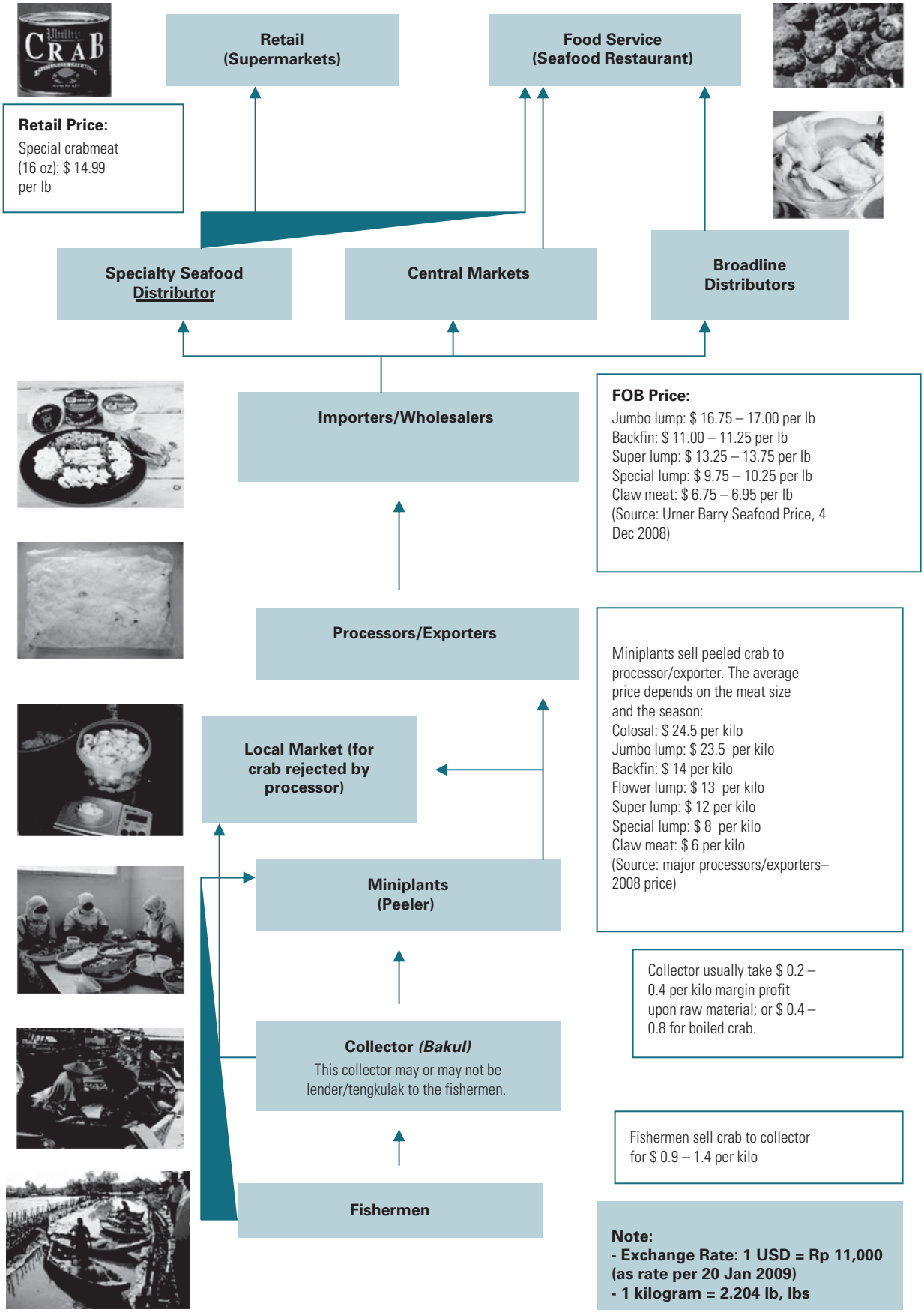
There are two main activities in the miniplant: cooking and picking. The miniplants buy raw material from the fisherman or middleman *(bakul)* by cash. Raw materials are sorted, grouped, and weighted according to size. If the crabmeat products are rejected due to quality failure (off-flavors and

FIGURE 2.2: Major Blue Swimming Crab Catching Areas in Indonesia (1990–2006)



Source: Statistics of Indonesia Capture Fisheries, Ministry of Marine and Fisheries Affairs (various years).

FIGURE 2.3: Value Chain and Stakeholders Involved in BSC Fisheries in Indonesia



Source: Anggraeni 2011.

off-textures), miniplants will sell them to the local market. The worst quality product will be sold to shrimp paste (*terasi)* manufacturing.

2.2.1.4 Market

The BSC is not in high demand in Indonesia. Almost 95 percent of the BSCs caught in Indonesia are exported. The export of BSCs started in 1994 due to increased demand from overseas. Before this, BSCs were only consumed locally and the price was very low. Currently, crab products have been the third largest export fishery product by value, following shrimp (46 percent) and tuna (14 percent). In 2007, BSCs contributed to about 8 percent of total Indonesian fishery products export, valued at US$179 million, up 33 percent from 2006. Total crab exports amounted to 21,510 tons in 2007, consisting of nonfrozen crab (82 percent), canned crab (11 percent), and frozen crab (7 percent) (MMAF and JICA 2009).

More than half of the BSC products are exported to the United States, followed by Singapore (17 percent), Malaysia (10 percent), Taiwan (7 percent), European Union (6 percent), China (5 percent), and Japan (2 percent). In 2008, the total U.S. crab import from Indonesia was 9,372 tonnes, a decrease of 15 percent from 2007. However, the average price has increased by 21 percent from US$14.5 per kilo in 2007 to US$17.5 per kilo in 2008, leading to a 6 percent increase by value (NMFS 2011). More than 85 percent of crab imported to the United States from Indonesia was in ATCs (airtight containers) or canned, while another 10 percent was frozen and another 5 percent was in other preparations.

2.2.1.5 Overfishing

Currently, there are no direct controls on the harvest of BSCs in Indonesia. Fishers can catch any size of crab and sell it to the picking plants. The utilization level of BSC has probably met or even exceeded the Maximum Sustainable Yield level. Some catch reports in recent years indicate that the average size of landed BSCs is becoming smaller. Preliminary assessment by a stock modeling expert suggests that the resources have been fished down to some extent, but there is insufficient data to proceed much further toward any form of quantitative stock assessment (SFP 2010).

2.2.1.6 Measures Taken Toward Sustainability

In 2007, an Association of Indonesian BSC Processors (Asosiasi Pengelolaan Rajungan Indonesia, APRI) was formed, with the goal of sustainable procurement from healthy stocks. APRI currently consists of 11 leading crab processing and exporting companies in Indonesia, representing over 90 percent of crab exported from Indonesia to the U.S. market. A Marine Stewardship Council (MSC) preassessment of Indonesia BSC fishery was conducted in 2009 and highlighted the lack of reliable scientific data on stock status and the absence of any fishery management as significant issues. Currently, a work plan has been developed and implemented in order to address the deficiencies identified by the MSC preassessment report and improve the fishery management to meet MSC standards. Some management options have been proposed by stakeholders, such as the adoption of an incremental minimum legal size; a ban on the take of berried (egg bearing) females; changes in fishing gear (such as escape gaps in crab pots); a hatchery project; efforts to protect nursery and spawning grounds; time/area closures; a registration system for all purchasers of crabs, both live and processed (to improve data collection); and fishing effort controls (including specifying legal gear types and minimizing net length and the number of pots).

2.2.2 The Philippines Blue Swimming Crab (BSC) Fishery[3]

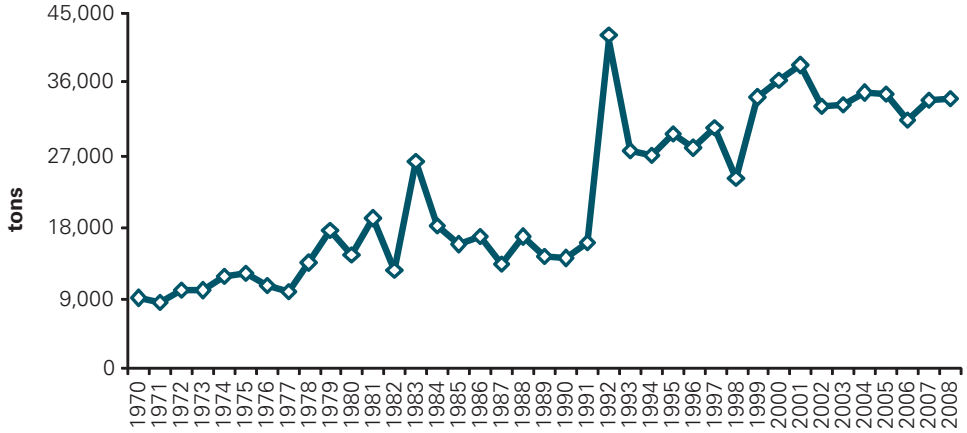
2.2.2.1 Landings

The Philippines BSC (*Portunus pelagicus*) is called *kasag* (Hiligaynon), *alimasag* (Tagalog), *lambay* (Bisaya), *kagang sukay* (Tausog), and *kappi* (Ilokano) in different languages. It is traditional seafood in the country, but was not a targeted species. It used to be a preferred by-catch of finfish fishery and some fishing gears such as fish corrals. BSC fishery has become an important fishery since the increase in demand of pasteurized BSC meat from the United States. The trend of the total landings of BSCs in the Philippines shows two major eras (figure 2.4). Before the early 1990s, the major market was mostly domestic. From the mid-1990s to the present, the industry became more export oriented. In the past 10 years, average production has been around 34,000 tons.

BSCs' distribution is within the coastal areas on sandy substrates and on strictly marine environment. Juvenile BSCs are usually found on the intertidal and subtidal areas where they land for shelter and foraging, particularly on seagrass, seaweed, and algal beds and mangrove areas. There were at least two biological stocks of BSCs in the Philippines: one in the Visayan Sea and surrounding inland waters (i.e., Bohol Sea) and one in Tawi-tawi waters (Romero 2009). The major fishing grounds of BSCs in the Philippines are the inland waters of Central Philippines, which are almost interconnected with the Visayan Sea, including San Miguel Bay facing the

3 This part is based on the report written by Jimely Flores from Sustainable Fisheries Partnership (SFP).

FIGURE 2.4: Landings of BSCs in the Philippines



Source: FAO 2011.

Pacific Ocean, Malampaya Sound facing South China, and the Tawi-tawi group of islands (Ingles 2004). Some small-scale crabbing areas include Lingayen Gulf, Manila Bay, and Honda Bay. The major crabbing areas comprise 87.7 percent of the total BSC landings in 2007.

2.2.2.2 Fishing Efforts

The traditional methods of collecting BSCs include simple picking and diving, *bintol* (crab liftnet), fish corrals, and bamboo pots/traps (Ingles 1996; Ingles 2004). At present the industry is using gillnet as major fishing gear, and some are using traps/pots. It is also a retained by-catch species of trawls and Danish seines.

BSC fisheries in the Philippines are mostly artisanal. Crabbers use either motorized or nonmotorized boats, which are usually below 3 GT with lengths ranging from 10 to 50 feet. Motorized fishing boats could be powered by 4 to 16 HP, while the big ones (lengths of 20 to 50 feet) may use the converted engines of land vehicles referred to by the fishers as 4DR (Isuzu) or 3R (Kubota).

There are no updated data on the number of fishers, fishing gear, and fishing boats involved in the BSC industry for the whole country. A study conducted in 2002 to 2004 in the Visayan Sea counted at least 2,522 fishing boats from 17 landing sites using either gillnet, bamboo pots, or PVC traps (Romero 2009). There were about 1,814 full-time fishers and 708 part-time fishers from those sites.

2.2.2.3 Issues of the Fisheries

Overcapacity: Overcapacity in the BSC fishery started when the export of pasteurized meat was intensified. In the Visayan Sea, Ingles (1996) estimated that the MSY level was 1,383 tons and the effort needed (based on the existing catch and effort data from 1990 to 1993) was about 13,150 gillnet panels. In 2000, the effort in the western Visayas alone was already 60,047 gillnet panels, 4.5 times more than the effort suggested to reach MSY level (Ingles and Flores 2000).

Growth Overfishing: Catch of juveniles is a concern for sustainable development of BSC fishery. Gillnet has higher probability to catch immature BSC than the bamboo trap/pot (table 2.4). One hundred percent of the catch of the pushnet, which operate in the seagrass areas were juveniles (Ingles and Flores 2000). Without any management intervention for this kind of practice, the overexploitation will likely become more serious.

High by-catch: By-catch is also a great concern, particularly for those using the gillnets. In the Northern Guimaras Strait, over half of the total catch of gillnet was by-catch, comprising 19 species of crabs (7 were retained and the remaining 12 species were discarded). Only about 40 percent of the catch is BSC. A variety of mollusks, sponges, and even some corals were not accounted for because they were removed upon hauling of the net. Ingles (2003) also identified the entanglment in gillnets used in BSC fisheries as one of the causes of death for the Irrawady dolphins, *Orchaella brivirostris,* an endangered species in Malampaya Sound, Taytay, and Palawan. Flores (2005) indicated that the BSC gillnet fisheries are also catching a significant volume of juvenile sharks (retained species) and other stingrays.

2.2.2.4 Value Chain

The value chain for the Philippines BSC fishery is demonstrated in figure 2.5. The fishers are using either gillnets (about 60 percent of the total production), traps/pots (about 30 percent share), or other fishing gear (10 percent) to catch

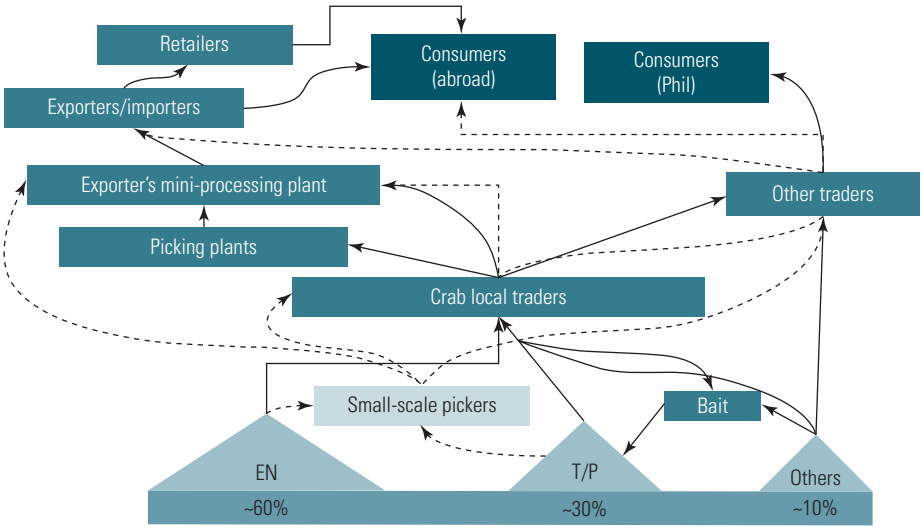
TABLE 2.4: Immature BSC Catch Rate for Different Gears

FISHING GEAR	MALE CAUGHT IMMATURE	FEMALE CAUGHT IMMATURE
Pushnet	100%	100%
Gillnet	27.5%	34.2%
Bamboo trap/pot	12.2%	26.5%

Source: Ingles and Flores 2000.

FIGURE 2.5: Supply Chain in the Philippines' Blue Swimming Crab Industry

Philippines' BSC supply chain



Source: Flores 2011.

BSCs. The fishers sell their crabs to the local traders, who sometimes are also the financiers. The crab traders will sell their crabs to the picking plants with a margin of 20 to 30 pesos/kg (US$0.5 to 0.7/kg) of live whole crab. In some cases when the local trader delivers exclusively to one picking plant, traders will also cook the crabs by using the facilities provided by the picking plant. Cooked crabs have an additional margin of PhP20 to 40/kg (US$0.5 to 0.9/kg).[4] Picking plants are set up and maintained by the exporters/processors. A price for picked crabmeat ranges from PhP600 to 700/kg (US$13.7 to 16/kg). The picked crabmeat is then delivered to the main processing plants for further quality control, packaging, and pasteurization. There are very few players in the BSC export market. Six exporting companies dominate the exports. The products are transported to the final country of destination in a chilled container with strictly controlled temperature. The wholesale prices in the United States are about US$8 to 10/lb ($17.6 to $22/kg) for the jumbo and US$4 to 6/lb($8.8 to $13.2/kg) for the lower classes of meat (like special). The pasteurized meat of the BSCs ranked as the fourth top export in 2007, amounting to about US$41 million export revenue. In addition to the United States, the Philippines also exports crabmeat to Hong Kong, Singapore, and other Asian countries (BFAR 2008).

2.2.2.5 Management Framework

The main legal framework with jurisdiction to the fisheries resources of the Philippines is the Republic Act 8550 (Philippine Fisheries Code). Under this law, the BSC fishery is classified under the municipal fisheries sector and is allowed to fish within the 15 km (radius from the shoreline) municipal waters of the country. This means that the use and management of this type of fishery is under the jurisdiction of the local government units (municipalities and provinces) as mandated by Republic Act 7160 (The Local Government Code). Further, Executive Order 305 (by the president of the Philippines) devolves the registration of fishing vessels 3 GT and less to the responsibility of the municipal and city governments.

4 1 US$ = 43.7 PhP (http://themoneyconverter.com/usd/php.aspx).

The Bureau of Fisheries and Aquatic Resources (BFAR) is mandated to manage the fisheries sector. At present, the BFAR initiated the creation of a BSC Management Plan wherein some regulatory measure would be implemented to ensure the sustainability of resources such as a creating a minimum legal size of 10.16 cm; putting a cap on the fishing effort by limiting the number and size (or number) of fishing gear; closing and opening fishing seasons and areas; and protecting the nursery sites of juvenile crabs.

There are also local government units. The Province of Negros Occidental in 2003 enacted a law prohibiting the catching and trading of berried crabs and crabs less than 11 cm in carapace width. The municipalities in Northern Iloilo (NIACDEV) prohibit the catching and trading of berried crabs and crablets; in 2012, this law was amended and crablets was changed to 11 cm as minimum carapace width limit. The municipalities of Guiuan, Eastern Samar, and Talibon, Bohol, enacted regulations banning the catching and trading of crabs less than 4 inches in size.

Chapter 3: FPIs' APPLICATION ON BSC FISHERIES—*OUTPUT* RESULTS

FPIs are applied to BSC fisheries in Indonesia and the Philippines. FPIs have set up 3.5 as a benchmark, meaning any fishery that has an indicator scored under 3.5 will have substantial room for improvement. It is useful to understand how a well-managed fishery will perform and how far these two studied fisheries are away from a currently well-managed fishery. Therefore, the Icelandic lobster fishery is selected as another benchmark because it is also an export-oriented fishery and has been recognized as a well-managed fishery after adopting the Individual Transferable Quota (ITQ) system in 1984 (Arnason 2002).

The FPI output indicators include three components, **Ecological Sustainability, Harvest Sector Performance,** and **Post-Harvest Sector Performance** (Anderson and Anderson 2010). This chapter will describe detailed results for each of these components.

3.1 ECOLOGICAL SUSTAINABILITY

The first component is **Ecological Sustainability**, measuring the fish stock health and its harvest status in order to understand whether the physical fishery resource is in good shape and has the ability to create sustainable wealth. It is the average of four indicators, including *Proportion of Harvest with a Third-Party Certification*, *Fish Stock Sustainability Index (NMFS)*, *Percentage of Stocks Overfished*, and *Nonlandings Mortality*. The scoring scale and additional information for each indicator are shown in table 3.1. A more detailed explanation is found in Appendix A.

3.1.1 Fish Stock Health

As shown in figure 3.1, Icelandic lobster obtained full scores for three out of the four indicators of ecological sustainability. For Indonesian and Philippine BSC fisheries, three out of four scored in the range indicating a need for urgent improvement. Neither of these two fisheries obtained third-party certification or have a fish stock sustainability index because there is no effective management in place and lack of data. The Indonesian BSC fishery has lower nonlanding mortality but a higher percentage of overfishing compared to the Philippines BSC fishery.

In summary, with regard to **Ecological Sustainability**, the Icelandic lobster fishery performed well (4.8), indicating it is ecologically sustainable (figure 3.2). In contrast, ecological sustainability is a big concern for both Indonesian (1.8) and the Philippines BSC (1.3) fisheries. If the fishery resources are not physically healthy, it will undermine the potential for wealth creation for the local communities in the long run. According to the FPIs, the Indonesia BSC fishery needs to reduce overfishing, and the Philippines BSC fishery needs to reduce both overfishing, high retained by-catch species, and nonlanding mortality of other species (high nonretained by-catch species) to improve ecological sustainability.

3.1.1.1 Comments

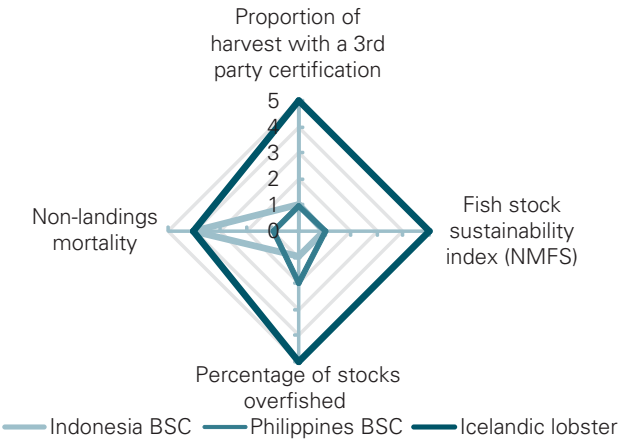
- *Proportion of Harvest with a Third-Party Certification*: Different countries can choose different certifications as long as they are well-recognized third-party certifications. With an increasing demand for certified seafood, this indicator should be easy to score and well represent the situation of the ecological sustainability for developed countries. However, because it is relatively expensive to obtain one certification for developing countries, it is expected the score will be very low or unattainable for many fisheries, particularly for artisanal small-scale fisheries in developing countries.
- *Fish Stock Sustainability Index:* This indicator measures if there are any measurements or efforts to correct overfishing and if the overfishing situation is improving. It is suggested that the definition be revised without referring to NMFS. This indicator can be changed to "Overfishing and Rebuilding," with a new definition of "Extent to which current effort affects stock status. For multistock fisheries, score each significant stock 1 to 5, then take a value-weighted average" (see Appendix B1).

TABLE 3.1: Score System for Indicators of Ecological Sustainability

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Proportion of Harvest with a Third-Party Certification	• **5**: 76–100% of landings are certified • **4**: 51–75% of landings are certified • **3**: 26–50% of landings are certified • **2**: 1–25% of landings are certified • **1**: No landings have third-party certification	The proportion of harvest (quantity) harvested under one of the recognized third-party programs that certify ecological sustainability, such as the Marine Stewardship Council (MSC) certification.
Fish Stock Sustainability Index (NMFS)	For each of four components, each stock receives: one point if the status of the stock is overfished or subject to overfishing; two points if management measures are succeeding at preventing overfishing; three points if the stock biomass is above the level defined as overfished for the stock; and four points if the stock is rebuilt or is at its "optimal" level, within 80% of that required to achieve maximum sustainable yield. The FSSI is computed by summing the scores of the individual stocks. Points by quintile are relative to the maximum possible score; with 5 points for the highest quintile.	The Fish Stock Sustainability Index. The FSSI is calculated by assigning a total score between 0 and 4 to each priority fish stock. Note: The number of priority stocks will differ between management systems (The Fish Stock Sustainability Index, 2009).
Percentage of Stocks Overfished	• **5**: None overfished • **4**: 1–25% of stocks overfished • **3**: 26–50% overfished • **2**: 51–75% overfished • **1**: 76–100% overfished	Percentage of commercial stocks within the management authority's preview that are considered overfished, to be experiencing overfishing, or in generally unknown stock status (whether actively managed or not).
Nonlandings Mortality	• **5**: Virtually none • **4**: Less than 5% • **3**: 5–10% • **2**: 10–20% • **1**: More than 20%	Ratio of estimated mortality of the assessed target species from illegal harvest, by-catch, illegal discards, regulatory (legal) discards, and other nonlandings waste to actual landings.

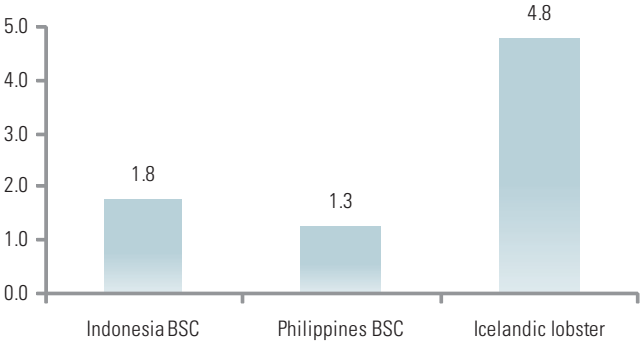
Source: Anderson and Anderson 2010.

FIGURE 3.1: Fish Stock Health and Environmental Performance



Source: Authors.

FIGURE 3.2: Ecologically Sustainable Fisheries



Source: Authors.

- *Percentage of Stocks Overfished*: This states the situation of whether the studied fishery is overfished. Experts from Indonesia and the Philippines felt it was difficult to score because there was no biological reference point. This issue will occur whenever the expert wants to rely on precise data to score. The goal of FPIs is to be able to conduct a rapid assessment for data-poor countries. Experts' good estimation and judgment of the situation is enough. For example, if the average catch size and volume or catch per unit effort (CPUE) is declining with years, it is reasonable to judge that the stock is overfished without formal stock assessment data.
- *Nonlandings Mortality*: Similar to overfishing, this will rely on experts' experience or studies for those fisheries lacking data and management in place. Additionally, there are two types of mortality. One is

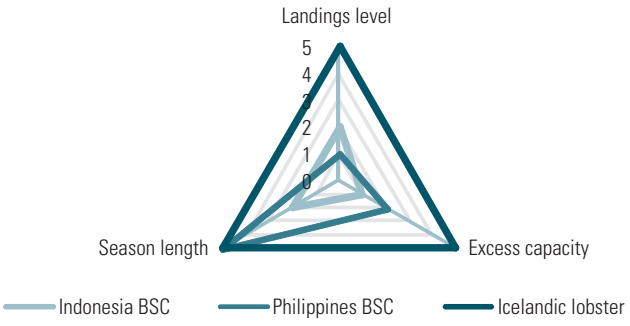
induced by regulatory requirements to discard landed fish. One is induced by the selection of gears, fishing methods, and so forth. In order to distinguish these two, it is suggested to change this one indicator to two indicators, *Regulatory Mortality* and *Selectivity*. See Appendix B1 for the score systems.

- There are also no indicators to show whether the critical habitat is protected or if there are MPAs existing and functioning, because these will affect the recruitment of fisheries. It is suggested to add *Status of Critical Habitat* to capture the habitat's situation (see Appendix B1 for the suggested score system).

3.2 HARVEST SECTOR PERFORMANCE

The second component is **Harvest Sector Performance**. It includes five dimensions, the *Harvest Performance, Asset Performance, Risk, Boat Owner/Manager Performance,* and *Crew Performance*. *Harvest Performance* captures essential aspects of efficiency in harvesting and thus the ability to generate sustainable wealth from the landings. *Asset Performance* characterizes how well harvest capital owners are able to invest in the fishery and how much future wealth is capitalized into the value of their rights and equipment. The *Risk* dimension reflects sources of risk in the fisheries that may inhibit investment or prevent the development of high-value supply chains. The indicators on *Owners, Permit Holders, and Captains* and *Crew* capture the social dimension of wealth distribution. Who benefits from the fishery? What are the relative income levels and social standing? Each dimension is an averaged result of a few indicators which will be explained as follows.

FIGURE 3.3: Harvest Performance



Source: Authors.

3.2.1 Harvest Performance

The score of the *Harvest Performance* is an average of *Season Length*, *Excess Capacity,* and *Landing Level*. The score system for each indicator is shown in table 3.2.

Icelandic lobster fishery achieved full scores for all the indicators (0.0.5) (figure 3.3). Regarding the *Landings Level*, Icelandic lobster harvest is less than MSY (Maximum Sustainable Yield) to increase profit. Indonesia BSC's harvest is constraining stock recovery, and Philippines BSC's harvest is overfished.

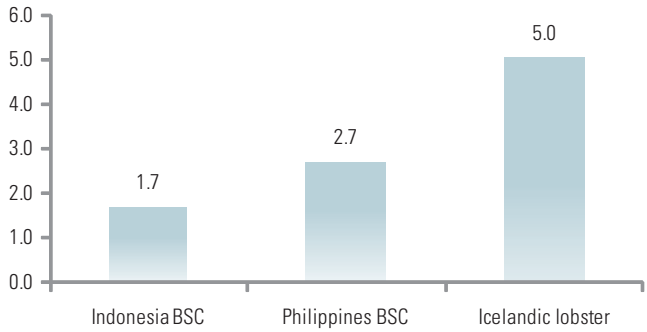
Regarding the *Excess Capacity*, Icelandic lobster scored 5 because the harvesting effort is managed by the processing manager according to the needs of final customers. Therefore, the excess capacity issue is not substantive. Both Indonesia and the Philippines BSC fisheries have an overcapacity issue in general—there are too many fishing boats. The number of boats needed is much less than what are currently operating. However, the overcapacity issue can vary

TABLE 3.2: Score System for Indicators of Harvest Performance

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Landings Level	• **5**: Harvest is less than MSY (stock is above MSY level) to increase profit • **4**: Harvest is approximately at MSY • **3**: Harvest reduced to promote recovery (stock is below MEY level) • **2**: Harvest is constraining stock recovery (stock is stable below MEY level) • **1**: Harvest is causing overfishing (stock is below MEY and declining)	Average annual harvest over the last 3 years. Note: in practice there are very few estimates of MEY, however where it has been calculated it is typically 5 to 10 percent less than maximum sustainable yield (MSY).
Excess Capacity	• **5**: Within 5% of days required • **4**: 105–120 or 90–95% • **3**: 120–150% or 75–90% • **2**: 150–200% or 50–75% • **1**: More than 200%, or less than 50%, of days required	Estimated standardized vessels-days required to catch the maximum economic yield (MEY) compared to the number of standardized vessel-days available. Days are considered not to be restricted by trip limits.
Season Length	• **5**: Virtually no regulatory closures • **4**: 91–99% • **3**: 51–90% • **2**: 11–50% • **1**: Less than 10%	Ratio of number of days on which fishing occurs to the number of days the species is available in economically feasible quantities.

Source: Anderson and Anderson 2010.

FIGURE 3.4: Summary of Harvest Performance



Source: Authors.

among regions. For example, in Indonesia, the excess capacity issue is much more serious in North Java Sea compared to East Sumatra.

Regarding the *Season Length*, both the Icelandic lobster fishery and the Philippines BSC fishery have no constraints on fishing. This does not mean they will go fishing all the time. Usually, they go when the weather is good. During low season, some fishermen will shift to other commodities or activities.

In summary, the Icelandic lobster fishery performed well in the harvest sector. The Indonesia BSC fishery and the Philippines BSC fishery received an average of 1.7 and 2.7, respectively, lower than the benchmark 3.5 (figure 3.4). They have an overcapacity issue, and the harvest level is constraining the stock recovery or causing overfishing. There is substantial improvement space in the harvest performance.

3.2.1.1 Comments

- The scale for the *Season Length* indicator is confusing. The definition now is the "ratio of number of days on which fishing occurs to the number of days the species is available in economically feasible quantities." This is primarily a measure of the extent of derby (including short regulatory seasons to limit total effort), not lack of biological availability or closures to prevent within-season growth overfishing. It does not count when it is bad weather or when the boat is under repair/maintenance. There is also a natural peak or low season for certain fisheries during different times of the year. For countries where there is no derby and fishermen can fish anytime they can, score 5 for this indicator.
- MSY, especially MEY (Maximum Economic Yield), data are not always available. This requires the expert to judge the situation according to his or her experience and relevant studies. Usually it is calculated as 5 to 10 percent less than maximum sustainable yield (MSY).
- It is noticed that the Catch per Unit of Effort (CPUE) is not used here. It might be because it is difficult to compare across boat types, across fisheries, and across countries. It is not easy to quantify what effort really means for each fishery. It can be per pot, per day, per person, per boat, or per mile. Unless a fishery and effort are clearly defined, it won't be comparable between fisheries. Therefore, even though it is a commonly used term, the authors support the idea of not using CPUE in the FPIs system.

3.2.2 Harvest Asset Performance

The *Asset Performance* dimension consists of six indicators, ranging from *Source of Capital* to *Borrowing Rate*. Table 3.3 gives a detailed score system for each indicator in this dimension.

Icelandic lobster received high scores in all the categories except Asset Value versus Historic High (figure 3.5) because recent political unrest has downgraded the quota transfer value. The asset value in Indonesia and the Philippines reflects only the value of the boats and gear because there is no quota or permit system in these two fisheries. There is no substantial difference between the boat value now and the past 10 years for BSC fisheries.

Icelandic lobster achieved the highest revenue in 2009. The BSC prices dropped in 2009 compared to the historic high, leading to a satisfactory score for the Icelandic lobster fishery (5) on *Total Revenue versus Historic High*. Both Indonesia (3) and the Philippines (2) BSC fisheries are below benchmark 3.5.

The capital is relatively well maintained among these fisheries. In Indonesia, boats last for about 10 years. Trap can be used for approximately 1 year, and the gillnet has to be replaced at least once a month. In the Philippines, boats are constructed with materials that are easily available and replaced. Therefore, the scores for *Functionality of Harvest Capital* are satisfactory.

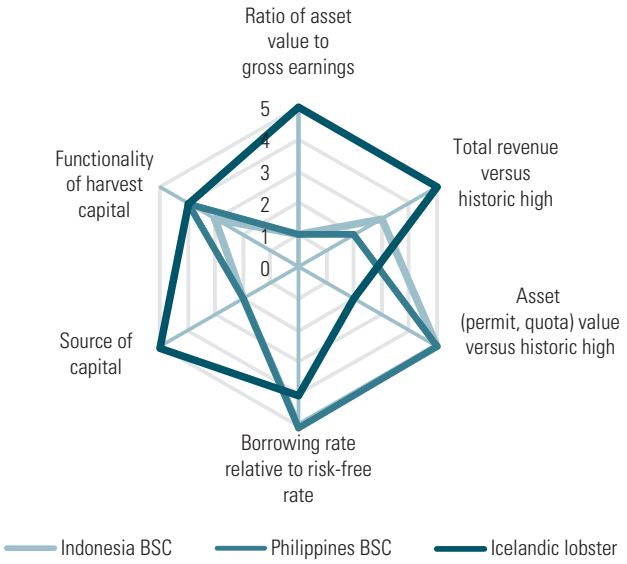
Indonesia and the Philippines BSC fisheries received the same scores for *Source of Capital* (2) and *Borrowing Rate Relative to Risk-Free Rate* (5), but the situations are different. In Indonesia, there is a vertical integration. The miniplants (picking plant) invest or loan to the collectors (*bakul*) through formal or well-recognized oral purchasing contracts. The miniplant will allow a collector to get a certain margin. If, somehow, both fishermen and collectors break the supply

TABLE 3.3: Score System for Indicators of Asset Performance

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Ratio of Asset Value to Gross Earnings	• **5**: 10 or higher • **4**: 7.5–10 • **3**: 5–7.5 • **2**: 2.5–5 • **1**: Below 2.5	Ratio of average price of access to the fishery over the last 5 years to the average annual landings value for a similarly scaled access right in the same period. Same business or same family sales are excluded, where they can be identified.
Total Revenue versus Historic High	• **5**: Above 95% • **4**: 86–95% • **3**: 71–85% • **2**: 50–70% • **1**: Below 50%	The indicator is the ratio of total revenue to the average of the three highest total revenues in the past 10 years.
Asset (Permit, Quota) Value versus Historic High	• **5**: Above 95% • **4**: 86–95% • **3**: 71–85% • **2**: 50–70% • **1**: Below 50%	The indicator is the ratio of asset to the average of the three highest asset values in the past 10 years.
Borrowing Rate Relative to Risk-Free Rate	• **5**: Less than 1.75; cf. 30-year conforming mortgage • **4**: Less than 2.5; cf. personal bank loan • **3**: Less than 4; cf. good credit card rates • **2**: Less than 7; cf. bad credit card rates • **1**: Greater than 7; usury	Average ratio between the interest rate on loans made in the industry to risk-free rates over the last 3 years.
Source of Capital	• **5**: Unsecured business loans from banks/venture capital • **4**: Secured business loans from banks/public stock offering • **3**: Loans from banks secured by personal (not business) assets/ government-subsidized private lending/government-run loan programs/international aid agencies • **2**: Microlending/family/community-based lending • **1**: Mafia/no capital available	Points to be assigned based on the category of lenders or investors that is most typically used in the fishery.
Functionality of Harvest Capital	• **5**: Capital is new • **4**: Capital is older but well maintained (e.g., freshly painted) • **3**: Capital is moderately well maintained • **2**: Maintenance is poor • **1**: Serious concerns about seaworthiness or safety throughout fishery	Average age of the key durable harvesting capital unit (vessels, weirs).

Source: Anderson and Anderson 2010.

FIGURE 3.5: Asset Performance

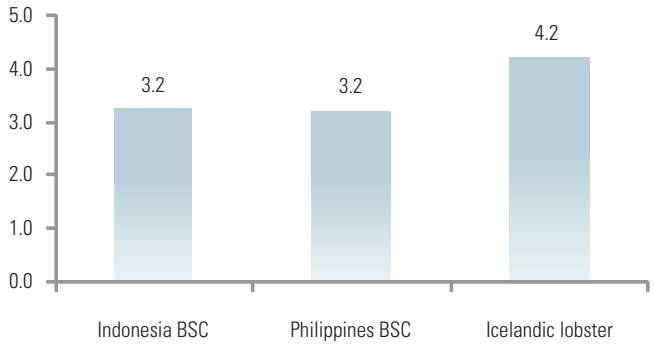


Source: Authors.

contract by selling their products to other competitors, the miniplant, as the biggest capital owner, will terminate all contracts with those fishermen and collectors. The fishermen's boats or other assets of collectors may be taken away. In the Philippines, most small-scale fishers use their savings or loans from family or close friends to invest, rarely from the bank.

In summary, the Icelandic lobster fishery achieved an average of 4.2 in the Harvest Asset Performance (figure 3.6). The lower asset value versus Historic High dragged the average score down. Both Indonesia and the Philippines BSC fisheries received an average of 3.2, indicating a substantial improvement need, particularly on better availability of financial system, asset value, and functionality of asset.

FIGURE 3.6: Summary of Asset Performance



Source: Authors.

3.2.2.1 Comments

- *Borrowing Rate Relative to Risk-Free Rate*: If the money is borrowed from family or friends, the rate should be the interest rate of savings as opportunity cost if putting money to the bank is a common practice. Or else, the interest rate can be zero. However, there might be some in-kind payback, which is not reflected in the score system or explanation. Additionally, for developing countries, a risk-free rate can be hard to define. It is suggested to add "family or friend's support" to 5 and "in-kind payback" to 4 (Appendix B).
- *Source of Capital*: It is suggested that "contract relationship between the processors and producers" be added into score 2.

3.2.3 Risk Exposure

The fishery industry is a high-risk industry. Risk exposure uses a series of indicators to summarize the potential exposure of the fishing industry to various economic and social risks (table 3.4), including price volatility, revenue volatility, and legal challenges.

The Icelandic lobster fishery has very limited risks in terms of harvest revenue, landings, and price volatility (figure 3.7). It is a well-managed, demand-driven fishery. There is no obvious difference between months, years, and areas due to consistent supply and demand of lobster. The Icelandic lobster fishery only has some political risk, leading to a lower score on *Contestability and Legal Challenges*.

The Philippines BSC fishery has relative low risks in terms of *Landings* and *Price Volatilities* between years and months based on FPIs scores (figure 3.7). However, the *Spatial Price Volatility, Legal Volatility,* and *Annual Revenue Volatility* are concerns. Legal volatility comes from low enforcement of most regulations.

The Indonesia BSC fishery did not have significant spatial price difference compared to the Philippines fishery, but it had more *Landings* and *Price Volatility* between years and months. This may be because (1) there are some "peak seasons" and "low seasons" in crab fishing in Indonesia that create monthly price differences. Usually the price will be higher during the low season and lower during the peak season. (2) The Indonesian expert used U.S. import data to calculate this group of indicators, and the Philippine expert used ex-vessel data.

In summary, all three fisheries are facing relative manageable risks with an average score higher than 3.5 (figure 3.8). The Indonesia BSC fishery is facing more potential economic risk; therefore, more attention needs to be paid to annual landing and price volatility.

3.2.3.1 Comments

- Risk Exposure indicators are clearly identified and quantitative. There might be a data availability issue in some developing countries in price data collection, especially on monthly data and regional price data. This will help identify data gap and encourage setting up economic data collection.

3.2.4 Boat Owners/Captain

The earning and status of *Boat Owners/Captains* reflect whether a fishery is profitable, equitable, and sustainable. This group of indicators is meant to capture not only the economic well-being, but also the social stability level, including the relative income level, *Education* and *Health Care Access*, *Social Standing,* and *Proportion of Nonresidents* (table 3.5).

The Indonesia BSC fishery performed well with three indicators achieving higher scores (figure 3.9). The earnings of Indonesia BSC boat owners, who are often miniplant owners or people with financial ability, were eight times more compared to the national average. The captain's average wage is nearly twice that of average nonfishery wages. This leads to their relatively high social standings. In contrast, the relative situation of boat owners and captain for Icelandic lobster fishery and the Philippines BSC fishery is not as good as those in Indonesia.

Both Indonesia and the Philippines BSC fisheries did not receive high scores in terms of *Access to Health Care*. In Indonesia, there are some government-owned small health care facilities (*Puskesmas*) in each subdistrict (*kecamatan*) that provide health service to local people. In the Philippines, medical treatment is seldom accessible and relies more on self-meditation by buying basic drugs from some community stores. *Access to Education* is satisfactory for all of them.

TABLE 3.4: Score System for Indicators of Risk Exposure

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Annual Total Revenue Volatility	• **5**: 0.14 or less • **4**: 0.15–0.21 • **3**: 0.22–0.39 • **2**: 0.40–0.99 • **1**: 1 or greater	Ratio of the standard deviation of the first differences of annual total revenue to the mean total revenue over the last 10 years.
Annual Landings Volatility	• **5**: 0.14 or less • **4**: 0.15–0.21 • **3**: 0.22–0.39 • **2**: 0.40–0.99 • **1**: 1 or greater	Ratio of the standard deviation of the first differences of annual total landings sold to the mean landings over the last 10 years.
Intra-Annual Landings Volatility	• **5**: 0.14 or less • **4**: 0.15–0.21 • **3**: 0.22–0.39 • **2**: 0.40–0.99 • **1**: 1 or greater	Ratio of the standard deviation of the weekly/monthly total sold landings over the last 3 years to the mean landings. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is no meaningful variation at a monthly level, this measure can be NA.
Annual Price Volatility	• **5**: 0.12 or less • **4**: 0.13–0.19 • **3**: 0.20–0.30 • **2**: 0.31–0.84 • **1**: 0.85 or greater	Ratio of the standard deviation of the first differences of annual ex-vessel price to the mean price over the last 10 years.
Intra-Annual Price Volatility	• **5**: 0.12 or less • **4**: 0.13–0.19 • **3**: 0.20–0.30 • **2**: 0.31–0.84 • **1**: 0.85 or greater	Ratio of the standard deviation of average monthly ex-vessel price over the last 3 years to the mean. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is no meaningful variation at a monthly level, this measure can be NA.
Spatial Price Volatility	• **5**: 0.12 or less • **4**: 0.13–0.19 • **3**: 0.20–0.30 • **2**: 0.31–0.84 • **1**: 0.85 or greater	Ratio of the standard deviation across data collection regions of average annual ex-vessel price to the mean. Measure should be averaged over the last 3 years.
Contestability and Legal Challenges	• **5**: No significant legal challenges, civil actions, or protests regarding the fishery management system • **4**: Minor legal challenges slow implementation • **3**: Legal challenges, civil actions, or protests impede some management measures • **2**: Legal challenges, civil actions, or protests suspend major elements of the management system • **1**: Legal challenges, civil actions, or protests suspend or prohibit implementation of key management reforms and regulation certification	

Source: Anderson and Anderson 2010.

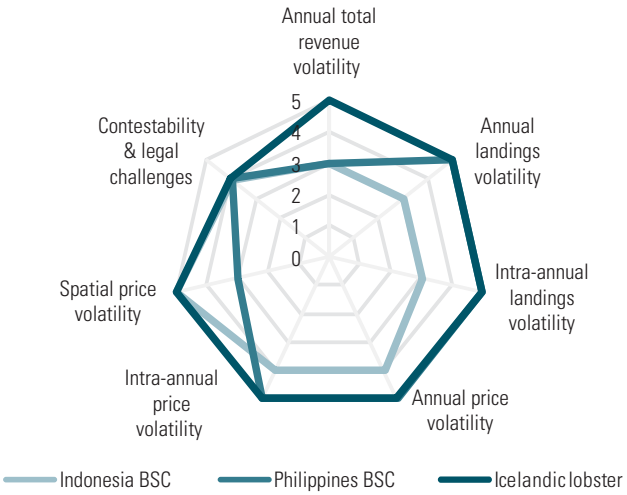
Boat owners in the Philippines and Indonesia can have access to good education.

In summary, Indonesia BSC fishery and Icelandic lobster fishery boat owners/captains are doing better than the benchmark (figure 3.10). They are relatively wealthy, ranked with high social standing, and receive good health care and education. The Philippines BSC fishery boat owners/captain achieved an average score of 2.8, lower than the benchmark 3.5. They need to improve their access to the health care system and income in general.

3.2.4.1 Comments

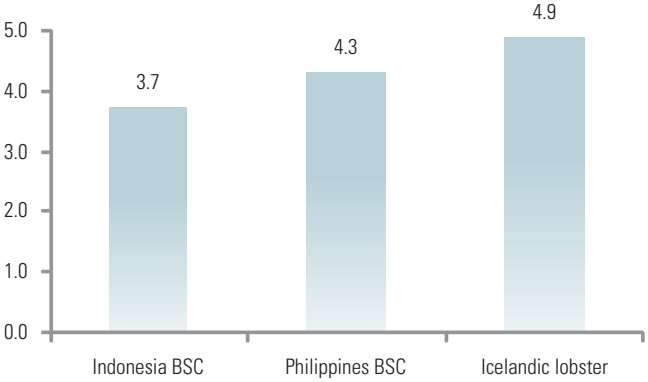
- The annual earnings and wages are sensitive data. For some developing countries, it is not easy to obtain the data.
- Currently, there are two wage comparison indicators, one to national average and one to nonfishery. It is suggested to use *Earnings Compared to Regional Average* to replace the original two indicators as it is more relevant to compare to the regional average instead of the national average (see Appendix B).

FIGURE 3.7: Risk Exposure



Source: Authors.

FIGURE 3.8: Summary of Risks



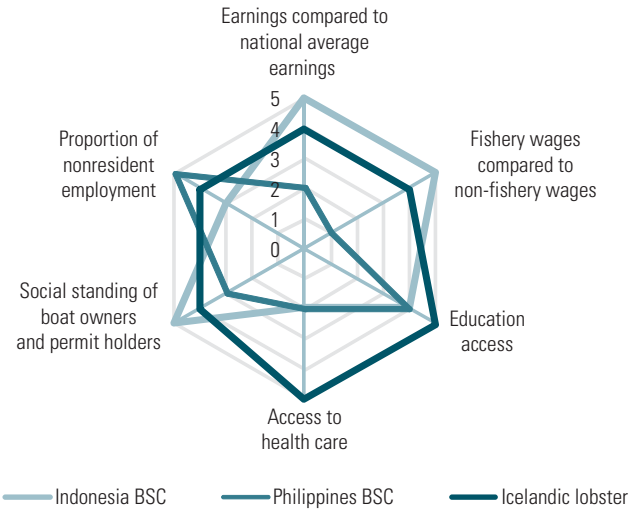
Source: Authors.

TABLE 3.5: Score System for Indicators of Boat Owners/Captain

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Earnings Compared to National Average Earnings	• **5**: More than 50% above the national average • **4**: Between 10 and 50% above national average • **3**: Within 10% above the national average • **2**: Between 50% and 90% of the national average • **1**: Less than half of the national average	Ratio of annual earnings from fishing per owner to the national average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew.
Fishery Wages Compared to Nonfishery Wages	• **5**: More than 50% above the national average • **4**: Between 10 and 50% above the national average • **3**: Within 10% above the national average • **2**: Between 50 and 90% of the national average • **1**: Less than half of the national average	Ratio of captain's average daily wage to average daily wage in region/ country.
Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic education is accessible • **1**: Formal education is not accessible	
Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	
Social Standing of Boat Owners and Permit Holders	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
Proportion of Nonresident Employment	• **5**: 95–100% local • **4**: 71–95% local • **3**: 36–70% local • **2**: 5–35% local • **1**: Virtually no local crew	

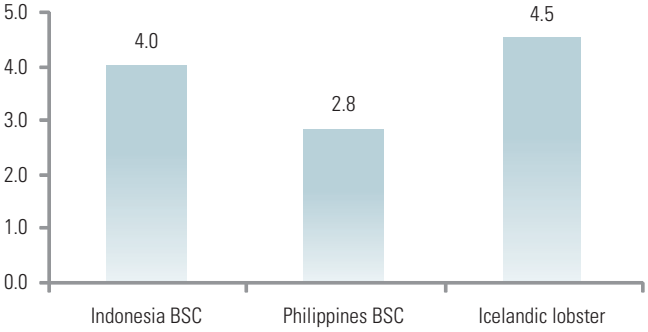
Source: Anderson and Anderson 2010.

FIGURE 3.9: Boat Owners/Captain



Source: Authors.

FIGURE 3.10: Summary of Boat Owners/Captain



Source: Authors.

- For certain fisheries, it is not necessary to have a captain. In those cases, this group of indicators is about the situation of boat owners.

3.2.5 Crew

Similar to the *Boat Owner/Captain*, this group of indicators focuses on the social status of the crews (table 3.6). Evaluating the economic and social performance of crew members can help us understand the equity of wealth distribution within the fishery sector by comparing with the performance of the boat owners/captains, or the cross-country situation by comparing with other countries' crews.

All three fisheries have well-represented age groups (score 5) and crew experiences (score 4), indicating a relatively stable fishery sector (figure 3.11). The difference is that Indonesia BSC fishery crews and Icelandic lobster fishery crews have better economic conditions compared to national average or nonfishery, but not the Philippines BSC fishery crews. However, their *Social Standings* are similar with a score of 2 or 3 as most of the time, fishery crews are regarded as skilled or nonskilled labor.

The scores of *Access to Education* for Indonesia and the Philippines BSC fisheries crew are low (2), compared to Icelandic lobster crews (5) or their own countries' boat owners/captains (4). In the Philippines, elementary and secondary education in state-run schools is free, but parents have to pay for the school supplies, uniforms, and other contributions which can be a hindrance for kids from going to school. Most crabbers' children finished at least the elementary level. After that, some male children are often asked to help their parents in the crabbing activities or other livelihoods. It is hard for the family to continue sending kids to school when they can make extra money for the family. These kids will probably grow and follow the paths of their parents. Thus the cycle of poverty, less education, and lack of opportunity repeat.

The score of *Access to Health Care* for the crew in Indonesia and the Philippines BSC fisheries crew is 2, the same as the one for boat owners/captain in these two countries, indicating a weak national health care system and a substantial improvement space.

Regarding the nonresident employment, the Philippines BSC fishery has almost all local crabbers (score 5), while Indonesia and Iceland have more nonresident fishermen (score 3) in their BSC and lobster fisheries.

In summary, Icelandic lobster crews are performing above the 3.5 benchmark in their communities with average scores of 4.3 (figure 3.12). Indonesia BSC crews and the Philippines BSC crews are doing marginally fine in their communities with an average score of 3.5 and 3.3, respectively. Their education and health care access have room for substantial improvement.

3.2.5.1 Comments

- Similar to Boat Owner/Captain, it is suggested to use *Earnings Compared to Regional Average* to replace the original two indicators (see Appendix B).
- The status of crew can vary with regions, boat type, or gear type. It is suggested to use the average or the representative crew to score this group of indicators.

3.2.6 Summary

The FPIs reasonably represent the situation of these three fisheries with regard to the **Harvest Sector Performance** (figure 3.13). In general, the harvest sector of the Icelandic

TABLE 3.6: Score System for Indicators of Crew

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Earnings Compared to National Average Earnings	• **5**: More than 10% above the national average • **4**: Within 10% of the average • **3**: Between 50 and 90% of the average • **2**: Between 25 and 50% of the average • **1**: Less than 25% of the average	Ratio of crew's average daily wage to average national wage.
Fishery Wages Compared to Nonfishery Wages	• **5**: More than 10% above the national average • **4**: Within 10% of the average • **3**: Between 50 and 90% of the average • **2**: Between 25 and 50% of the average • **1**: Less than 25% of the average	Ratio of crew's average daily wage to average daily wage in region/country.
Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic education is accessible • **1**: Formal education is not accessible	
Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	
Social Standing of Crew	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue-collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
Proportion of Nonresident Employment	• **5**: 95–100% local • **4**: 71–95% local • **3**: 36–70% local • **2**: 5–35% local • **1**: Virtually no local crew	
Crew Experience	• **5**: More than 20 years (skilled career crew) • **4**: 5–20 years • **3**: 3–5 years • **2**: 1–3 years • **1**: 0 full years of experience (mostly new crew each season)	Average years of experience of crew members.
Age Structure of Harvesters	• **5**: All working ages are well represented • **4**: Slightly skewed toward younger or older • **3**: Skewed toward younger or older • **2**: Almost entirely younger or older, but working age • **1**: Harvesters primarily younger or older than working age	Age range of both captains and their crews.

Source: Anderson and Anderson 2010.

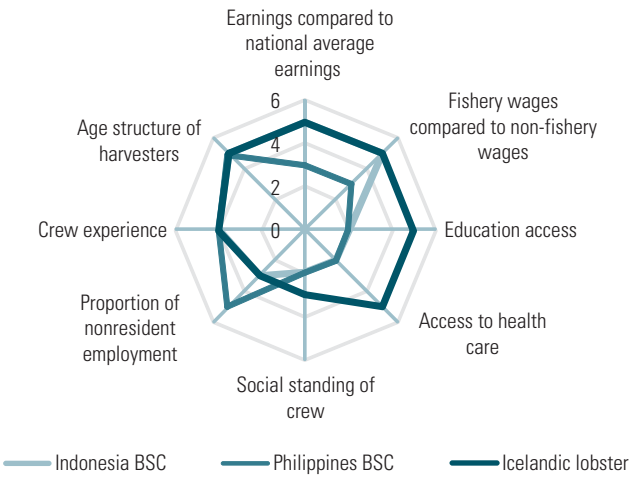
lobster fishery is performing well, with all the average scores for each category above the benchmark 3.5. The Indonesia BSC fishery performed well in terms of the *Boat Owner/Captain* but has a huge opportunity for potential improvement with regard to *Harvest Performance* and *Harvest Asset Performance*. The Philippines BSC fishery does not appear to have substantial risk exposure, but every other category in the harvest sector needs to improve substantially.

3.3 POST-HARVEST PERFORMANCE

The third component is the processing and marketing sectors (**Post-Harvest Performance**). The **Post-Harvest Performance** components measure success in the market and value chain.

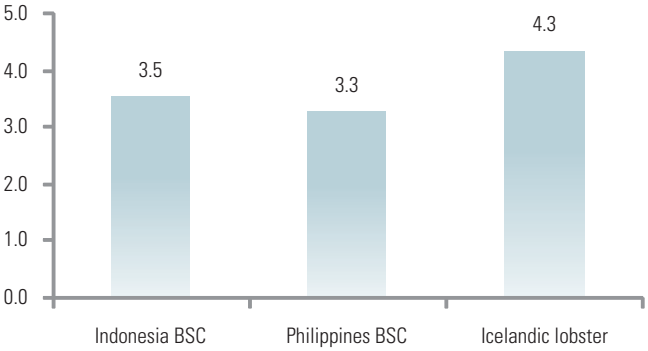
This component includes five dimensions, *Market Performance, Processing and Support Industry Performance, Asset Performance, Processing Owners/Managers,* and

FIGURE 3.11: Crew



Source: Authors.

FIGURE 3.12: Summary of Crew Performance



Source: Authors.

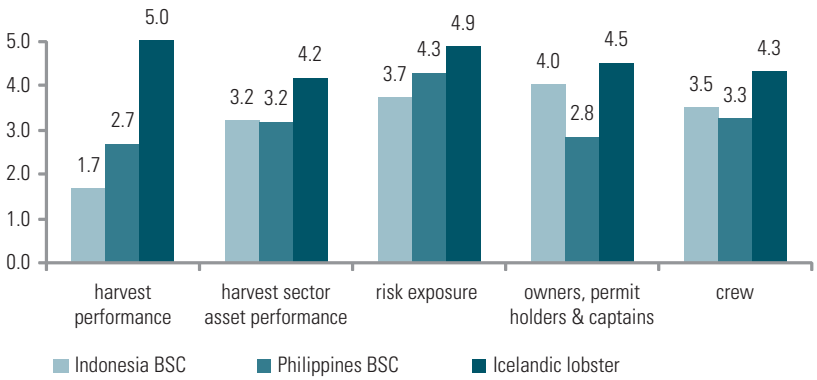
Processing Workers. The *Market Performance* dimension captures the effects of handling and processing on the price received for the product. The *Processing and Support Industry Performance* dimension captures processing efficiency and the extent to which the value of the product is being maximized. The remaining dimensions reflect wealth accumulation in the processing sector. The *Asset Performance* dimension captures the wealth accumulating to processing capital owners and the extent to which they can and do reinvest in the industry. The *Processing Owners and Managers* and *Processing Workers* dimensions capture the wealth that goes to each group as income and the extent to which it supports the fishing communities (Anderson and Anderson 2010).

3.3.1 Market Performance

The *Market Performance* is the average of seven indicators shown in table 3.7, measuring the price trend, margin, and market orientation.

The U.S. markets and EU markets are the main targets for these three fisheries; therefore, the *Capacity of Firms to Export* to those countries, the *Final Market Wealth*, and *Final Market Use* all receive high scores (figure 3.14). Indonesia exports most of their BSC products because BSC is not a locally favored species. Only rejected crabmeat product will go to the local market as food or shrimp paste material. The wholesale price of BSC depends on the type of crabmeat (usually categorized as Backfin, Lump, Super Lump, Claw, Jumbo Lump, and Special). Indonesia BSC received higher wholesale price (US$17/lb) ($37.4/kg) than the Philippines (US$8 to 10/lb) ($17.6 to $22/kg). The reason for this price difference is not clear from this quick assessment. One

FIGURE 3.13: Summary of Harvest Sector Performance



Source: Authors.

TABLE 3.7: Score System for Indicators of Market Performance

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Ex-Vessel Price versus Historic High	• **5**: Above 95% • **4**: 86–95% • **3**: 71–85% • **2**: 50–70% • **1**: Below 50%	The indicator is the ratio of annual ex-vessel prices to the average of the three highest annual ex-vessel prices in the past 10 years.
Final Market Use	• **5**: Premium human consumption (premium quality and products) • **4**: High-value human consumption • **3**: Moderate-value human consumption • **2**: Low-value human consumption • **1**: Fish meal/animal feed/bait or nonconsumptive	
International Trade	• **5**: 91–100% export • **4**: 61–90% export • **3**: 31–60% export • **2**: 2–30% export • **1**: Virtually no export	Percentage of the fishery's value that is from fish exported for consumption.
Final Market Wealth	• **5**: Greater than US$35,000 • **4**: Greater than US$25,000 • **3**: Greater than US$12,500 • **2**: Greater than US$5,000 • **1**: Less than US$5,000	Average per capita GDP of the consumer of a fishery's final product (pounds weighted by GDP). (U.S. CIA's rank of per capita GDP of all countries https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html).
Wholesale Price Relative to Similar Products	• **5**: More than twice global average • **4**: 120–200% of global average • **3**: Within 20% of global average • **2**: 50–80% of global average • **1**: Less than half global average	Ratio of average price for fish weight in wholesale (primary) fish product from the base country, to a global average for similar species.
Capacity of Firms to Export to the United States and European Union	• **5**: 96–100% approved • **4**: 71–95% • **3**: 36–70% • **2**: 5–35% • **1**: Virtually none approved	Percentage of a country's fish exports that are approved for export to the United States or European Union.
Ex-Vessel to Wholesale Marketing Margins	• **5**: Less than 0.3 • **4**: 0.3–0.5 • **3**: 0.5–0.8 • **2**: 0.8–0.95 • **1**: 0.95 or more	Ratio of ex-vessel price to wholesale price (adjusted for standard meat yield rates). To make the adjustment, divide the ex-vessel price by a standard processing yield, and divide by the wholesale price.

Source: Anderson and Anderson 2010.

possible reason is the Philippines have a bigger domestic market compared to Indonesia for the BSC. However, the ex-vessel price has dropped over 40 percent compared to the historic high in Indonesia. One benefit of the lower price is to broaden the range of consumers. The key issue facing Indonesia and the Philippines BSC fisheries with regard to market performance is that the margin profit is not highly captured within these two countries. They both received the lowest score (1) on *Ex-Vessel to Wholesale Marketing Margins*, indicating a potential significant wealth transfer outside these two countries.

In summary, the market performance for both Indonesia BSC and Iceland lobster fisheries are above the benchmark 3.5. The Philippines BSC fishery received an average score of 3.3 due to the lower price (figure 3.15). Both the Philippines and Indonesia BSC fisheries have huge opportunities to improve their ex-vessel margins.

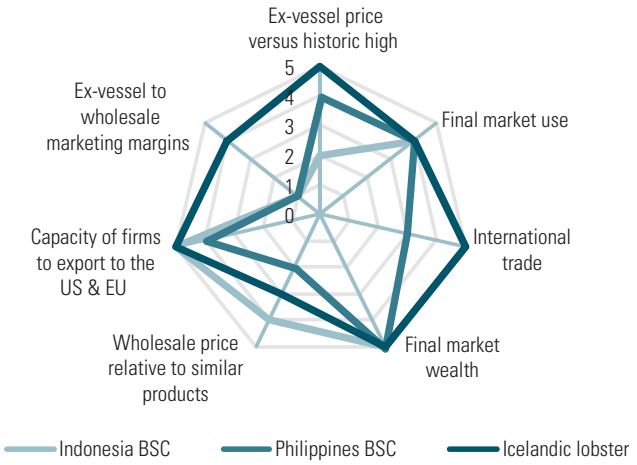
3.3.1.1 Comments

- It can be hard to estimate the average price for some fisheries because of different product forms. It is suggested to use the major product form as a representative to calculate.

3.3.2 Processing and Support Industry Performance

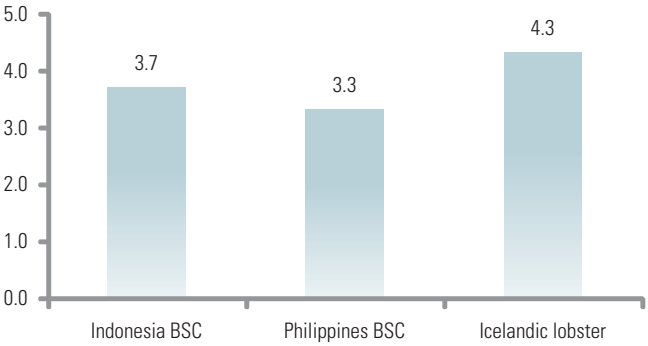
The ***Processing and Support Industry Performance*** is the average of five indicators, *Yield of Processed Product, Capacity Utilization Rate, Product Improvement, Regional Support Businesses,* and *Time to Repair*. This group of

FIGURE 3.14: Market Performance



Source: Authors.

FIGURE 3.15: Summary of Market Performance



Source: Authors.

indicators is designed to capture the potential of the value chain. The detailed score system is shown in table 3.8.

According to the FPIs scores, the Indonesia BSC is doing very well in the ***Processing and Support Industry***, with full scores for all of the indicators (figure 3.16). This might be due to some misunderstanding of the scale definition, which will be explained below. All of these fisheries achieve full scores on *Product Improvement* because they all target the value-added export market. Both Indonesia and the Philippines serve as BSC landing and processing centers. They export canned, pasteurized BSCs and frozen BSCs. The specifications and packaging come from the order of the buyer or importer, which are usually large seafood companies. The *Time to Repair* is usually short because the processing equipment is not sophisticated. They only need knives, scissors, and electric pumps. In Indonesia, the processing facilities open every day except religious holidays (Hari Raya). There is adequate raw material supply in Indonesia and thus is more fully utilized than the Philippines.

In summary, the average performance of the **Processing and Support Industry** in both Indonesia BSC and Icelandic lobster fisheries are above the benchmark 3.5 (figure 3.17). Only the Philippines BSC fishery received a score of below 3.5. It has substantial room for improvement on the utilization rate, yield efficiency, and regional support.

3.3.2.1 Comments

- With regard to *Yield of Processed Product*, there appears to be some confusion. The definition of this indicator is "Ratio of actual yield (pounds) to the maximum yield technically achievable." The Philippine expert scored it according to the definition. Based on the maximum yield of 30 percent, the Philippines BSC processing yield is 23 percent; therefore, the ratio is 76.7 percent, indicating a score of 2 "within 25 percent." The Indonesian expert thought it meant what is the maximum they can sell. According to their rejection rate of 2 to 5 percent for the processed crabmeat, they scored 5 since they can sell almost everything they processed. This was not what the score intended to do. It is more likely that the Indonesia BSC fishery received 2 or 3 for this indicator instead of 5 considering their technology will not be very different. However, the rate of yield also depends on the size of the crabs. The bigger the crab, the higher is the crabmeat yield. It is suggested to use the average rate if there are a few different forms or sizes.
- In terms of *Regional Support Businesses*, the Indonesia expert gave a score of 5 because all of the required equipment for processing is simple and easy to replace. The Philippines expert gave a score of 1 because there is no other regional business support. Regional support has a much broader meaning than repairing the equipment. It is more than the processing sector itself, including the business environment, transportation, services, and so on. Therefore, it is more likely this score for Indonesia is lower, maybe 4 or 3 instead of 5.
- With the above two corrections, the average score for the Indonesia BSC fishery will be between 4 and 4.4, still higher than the benchmark.

3.3.3 Post-Harvest Asset Performance

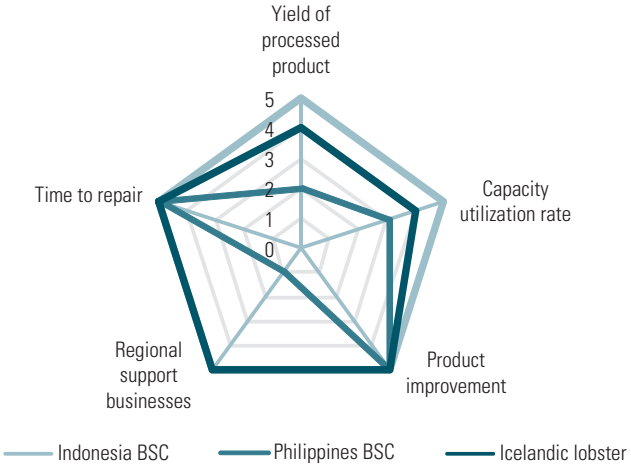
The *Asset Performance* is the average of *Borrowing Rate Relative to Risk-Free Rate, Source of Capital,* and *Age of Facilities* (table 3.9).

TABLE 3.8: Score System for Indicators of Processing and Support Industry Performance

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Yield of Processed Product	• **5**: At feasible frontier • **4**: Within 5% of the feasible frontier • **3**: Within 10% • **2**: Within 25% • **1**: Less than 75% of maximum yield	Ratio of actual yield (pounds) to the maximum yield technically achievable.
Capacity Utilization Rate	• **5**: Virtually year-round • **4**: 76–95% of days • **3**: 51–75% • **2**: 20–50% • **1**: Less than 20%	Days open for processing each year. Such days would not normally include religious or civic holidays, or weekly rest days.
Product Improvement	• **5**: 76–100% of landings are enhanced • **4**: 51–75% • **3**: 26–50% • **2**: 1–25% • **1**: No landings have enhancements	Proportion of harvest meat weight going into certified, branded, or value-added products.
Regional Support Businesses	• **5**: All types of support are plentiful • **4**: Some types of support are capacity constrained or unavailable • **3**: Most types of support are capacity constrained or unavailable • **2**: Support limited to variable inputs • **1**: Industry support is not locally available	
Time to Repair	• **5**: Less than a week • **4**: One week to one month • **3**: One month to less than a season • **2**: Full season • **1**: Major repair not possible	Days required to make a major mechanical repair to a vessel (e.g., blown valve) that requires a replacement part, including wait time.

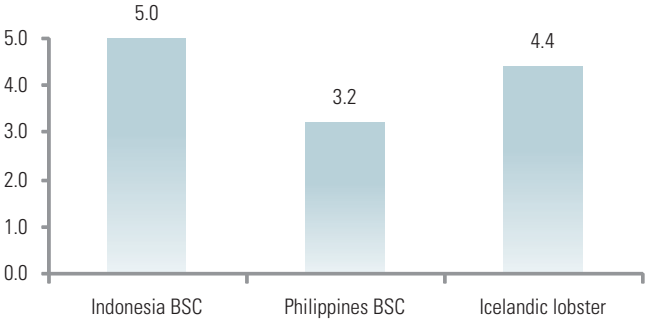
Source: Anderson and Anderson 2010.

FIGURE 3.16: Processing and Support Industry Performance



Source: Authors.

FIGURE 3.17: Summary of Processing and Support Industry Performance



Source: Authors.

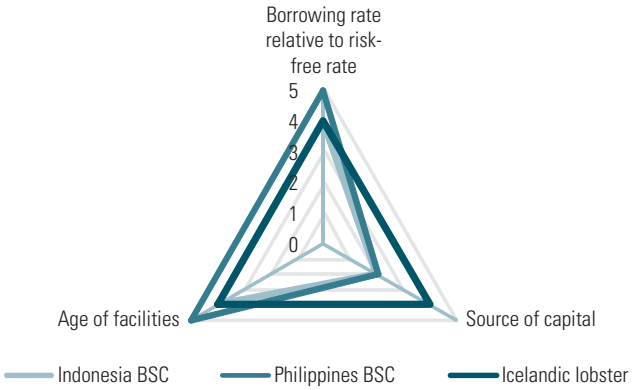
Both Indonesia and the Philippines perform well with regard to the asset performance for post-harvest chain (figure 3.18). In the Philippines, *Sources of Capital* for the crabbing industry are usually from family savings or informal loans, instead of from banks or any formal lending agencies, particularly for the picking plants. For the very few pasteurizing plants, they can get secured loans at the rate of 9 to 16 percent. In Indonesia, the miniplants (picking plants) normally get financial support from the processors/exporters. All the facility and equipment were supplied by specific processors/exporters and became assets of the miniplants. As a return, these miniplants have to supply to these processors/exporters.

TABLE 3.9: Score System for Post-Harvest Asset Performance

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Borrowing Rate Relative to Risk-Free Rate	• **5**: Less than 1.75; cf. 30-year conforming mortgage • **4**: Less than 2.5; cf. personal bank loan • **3**: Less than 4; cf. good credit card rates • **2**: Less than 7; cf. bad credit card rates • **1**: Greater than 7; usury	Average ratio between the interest rate on loans made in the industry to risk-free rates over the last 3 years.
Source of Capital	• **5**: Unsecured business loans from banks/Venture capital • **4**: Secured business loans from banks/public stock offering • **3**: Loans from banks secured by personal (not business) assets/government-subsidized private lending/government-run loan programs/international aid agencies • **2**: Micro lending/family/community-based lending • **1**: Mafia/no capital available	Points to be assigned based on category of lenders or investors that is most typically used in the processing sector.
Age of Facilities	• **5**: Less than 7 years; first quarter of expected life • **4**: 7–15 years; second quarter of expected life • **3**: 16–20 years; third quarter of expected life • **2**: 21–25 years; fourth quarter of expected life • **1**: Greater than 25 years; exceeding expected life	Average age of the key durable processing capital unit (plants, catcher-processor vessels).

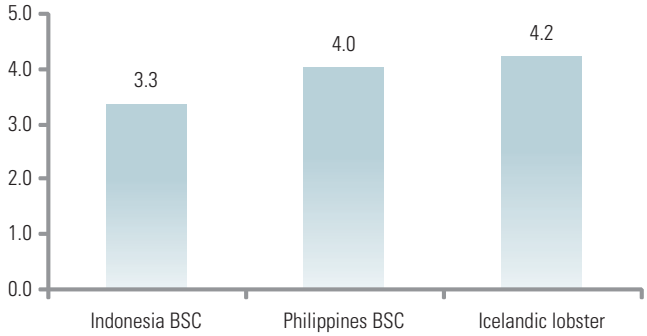
Source: Anderson and Anderson 2010.

FIGURE 3.18: Post-Harvest Asset Performance



Source: Authors.

FIGURE 3.19: Summary of Post-Harvest Asset Performance



Source: Authors.

There are also very limited government programs called PNPM (National Program for Community Empowerment) that give small credits to the local community. Because of these types of informal financial support, the *Borrowing Rate Relative to Risk-Free Rate* scored high for all of them. They also performed satisfactorily with regard to *Age of Facilities*.

In summary, both Icelandic lobster and the Philippines BSC are performing satisfactorily in *Post-Harvest Asset Performance* (figure 3.19). The Indonesia BSC fishery performed close to the benchmark 3.5 due to the low score on *Source of Capital*.

3.3.3.1 Comments

- *Source of Capital*: For developing countries, it is suggested that "contract relationship between the processors and producers" be incorporated into score 2 as the situation for the harvest sector.

3.3.4 Processing Owners/Managers

Similar to the dimension for the *Boat Owners/Captain*, the social status of *Processing Owner/Managers* is evaluated in the same way by using indicators that can give a proxy picture about their wealth and social sustainability. This dimension includes six indicators as shown in table 3.10.

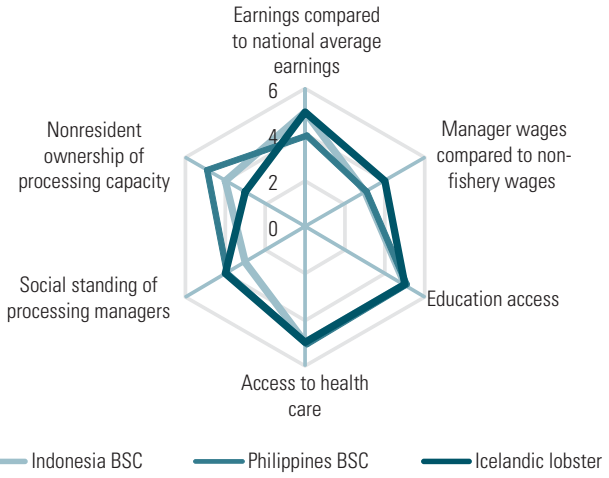
Processing Owners/Managers in Indonesia and Philippines for BSC are generally doing well (figure 3.20). They have relatively good access to education and health care, and make more money than the national average or nonfishery. In

TABLE 3.10: Score System for Processing Owners/Managers

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Earnings Compared to National Average Earnings	• **5**: More than 50% above the national average • **4**: Between 10 and 50% above national average • **3**: Within 10% above the national average • **2**: Between 50 and 90% of the national average • **1**: Less than half of the national average	Ratio of annual earnings from processing per owner to the national average earnings.
Manager Wages Compared to Nonfishery Wages	• **5**: More than 50% above the national average • **4**: Between 10 and 50% above national average • **3**: Within 10% above the national average • **2**: Between 50 and 90% of the national average • **1**: Less than half of the national average	Ratio of managers' average daily wage to average daily wage in region.
Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic education is accessible • **1**: Formal education is not accessible	
Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	
Social Standing of Processing Managers	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue-collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
Nonresident Ownership of Processing Capacity	• **5**: 96–100% local • **4**: 71–95% local • **3**: 36–70% local • **2**: 5–35% local • **1**: Virtually no local crew	Proportion of ex-vessel value processed by regionally owned processing capital.

Source: Anderson and Anderson 2010.

FIGURE 3.20: Processing Owners and Managers

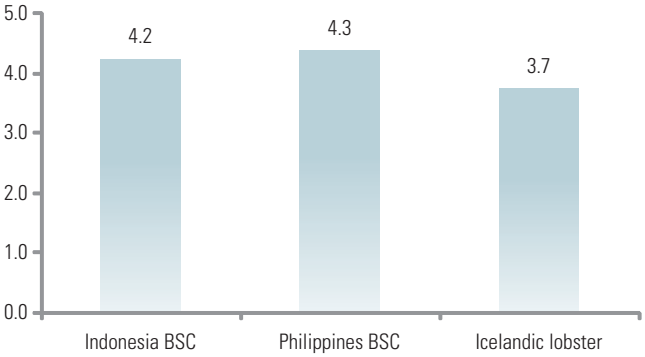


Source: Authors.

Indonesia, the processing company refers to the processor/packer/exporter (generally big companies) who buys crabmeat from miniplants, processes, packs, and then exports. In a miniplant, the owners usually manage the facility. The average processing capacity is about 500 kilo of raw material per day, resulting in 100 kilo of crabmeat. With a margin profit of IDR 5,000/kg[5] ($0.6/kg), their daily earnings are IDR 500,000/day ($60/day) or about IDR 15 million per month (US$1,775/month). Additionally, some processing plants also process *brangkas* (mainly chitin) mostly as feed, which will bring an additional IDR6 million (US$710) per month from sales of wastes. This income level allows the processing owners to have the financial ability to obtain good medical treatment or provide for their children higher levels of education (university). One key difference between these three countries is the proportion of nonresident ownership. The Philippines

5 1 US$ = 8450 IDR (http://coinmill.com/IDR_USD.html#USD=1).

FIGURE 3.21: Summary of Processing Owners/ Managers



Source: Authors.

has the highest local *ownership. In Iceland, over half of the owners are nonresidents.*

In summary, the *Processing Owners/Managers* performed above the benchmark for all three fisheries (figure 3.21). The high proportion of nonresident ownership can be a concern for the Icelandic lobster fishery but not an issue for Indonesia and the Philippines BSC fisheries. The Indonesia BSC fishery needs to raise the social standing for processing managers.

3.3.4.1 Comments

- *Nonresident Ownership of Processing Capacity*: The definition of bin 5 is 96 to 100 percent, and bin 4 is 71 to 95 percent. This leaves bin 5 a very narrow scale that is hard to achieve. For example, Indonesia chose 4, and their explanation is that most of the owners are local. It is suggested to change bin 5 to "91 to 100 percent" and bin 4 to "71 to 90 percent."
- *Processing Owner or Manager*: Whether FPIs are measuring managers or owners creates some confusion because they are two different groups and the score for each can be different. For example, in Indonesia, owners run the processing facilities. There is no manager in miniplants. There are field managers/ coordinators whose responsibilities are to supervise and oversee quality control. Those field managers/ coordinators are hired by the large company to ensure their raw material supply. Their annual income is much lower than that of the owners. If all of the scores are about processing facility owners, the shape of the graph will change, and Indonesia will perform exactly the same as the Icelandic lobster processing facility owners, except Indonesia will have more local owners. It is suggested to change the title to "Processing owner," deleting "manager."

3.3.5 Processing Workers

The social situation of *Processing Workers* is reflected by the same indicators as the *Processing Owner/Managers*, plus one indicator on *Worker Experience* (table 3.11).

Icelandic lobster processing workers have good *Access to Education* and *Health Care* (figure 3.22). Their wages are relatively better compared to nonfishery wages. However, Icelandic lobster processing workers have lower social standing. This might be because of the high proportion of nonresident employment in this sector in Iceland. Most of the processing workers in Iceland are from other countries. Indonesia processing worker conditions received a score just above 3.5, with more experience and better health care access. The Philippines has room for improvement. This group of indicators basically reflects the situation of processing workers in each country. They are clear and easy to score.

In summary, the conditions facing processing workers could be substantially improved in both Indonesia BSC and Philippine BSC fisheries (figure 3.23), particularly on education and health care access, income, and social standing. The conditions are marginally satisfactory for Icelandic lobster fishery, but the earnings and social standings are still much below the benchmarks.

3.3.5.1 Comments

- *Nonresident Ownership of Processing Capacity*: It is suggested to change bin 5 to "91 to 100 percent" and bin 4 to "71 to 90 percent" (see Appendix B).

3.3.6 Summary

The FPIs reasonably represent the situation of these three fisheries (figure 3.24) with regard to the **Post-Harvest Sector Performance.** The social situation of the processing workers is the weakest area for all three fisheries. Indonesia BSC fishery also needs improvement on Post-Harvest Asset Performance. The Philippines BSC fishery needs substantial improvement on *Processing and Support Industry*.

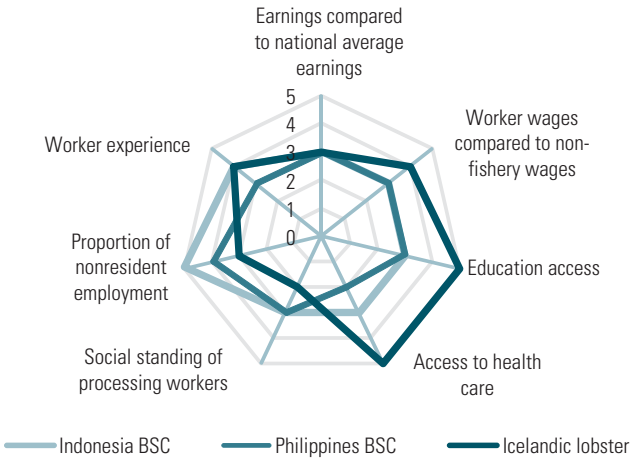
When averaging the score for each of the components discussed above, a summary of FPIs' output results can be obtained (table 3.12), which provides a big picture of the outcomes and illustrates clearly the ecological, economic, and social performance for each fishery. In all, the ecological status of both Indonesia BSC and Philippines BSC fisheries is a critical concern. They are below satisfactory to maintain the ecological sustainability. The *harvest sector* performance has substantial room for improvement in Indonesia and Philippines BSC fisheries. The post-harvest sector for all these three fisheries performs better than the harvest sector, above the benchmark 3.5.

TABLE 3.11: Score System for Processing Workers

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Earnings Compared to National Average Earnings	• **5**: More than 10% above the national average • **4**: Within 10% above the average • **3**: Between 51 and 90% of the average • **2**: Between 25 and 50% of the average • **1**: Less than 25% of the average	Ratio of annual earnings from per processing worker to the national average earnings.
Worker Wages Compared to Nonfishery Wages	• **5**: More than 10% above the national average • **4**: Within 10% above the average • **3**: Between 51 and 90% of the average • **2**: Between 25 and 50% of the average • **1**: Less than 25% of the average	Ratio of workers' average daily wage to average daily wage in region.
Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic education is accessible • **1**: Formal education is not accessible	
Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	
Social Standing of Processing Workers	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue-collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
Proportion of Nonresident Employment	• **5**: 96–100% local • **4**: 71–95% local • **3**: 36–70% local • **2**: 5–35% local • **1**: Virtually no local crew	
Worker Experience	• **5**: More than 20 years (skilled career crew) • **4**: 5–20 years • **3**: 3–5 years • **2**: 1–3 years • **1**: 0 full years of experience (mostly new crew each season)	Average years of experience of workers.

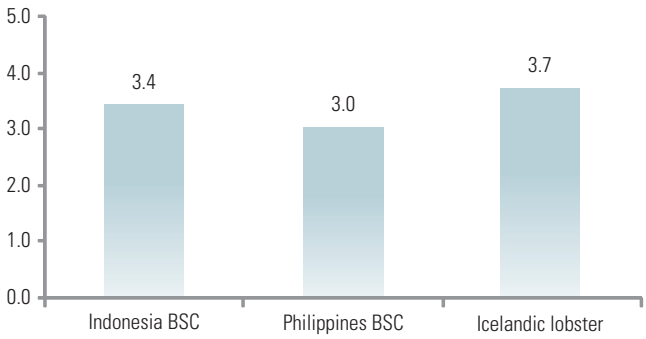
Source: Anderson and Anderson 2010.

FIGURE 3.22: Processing Workers



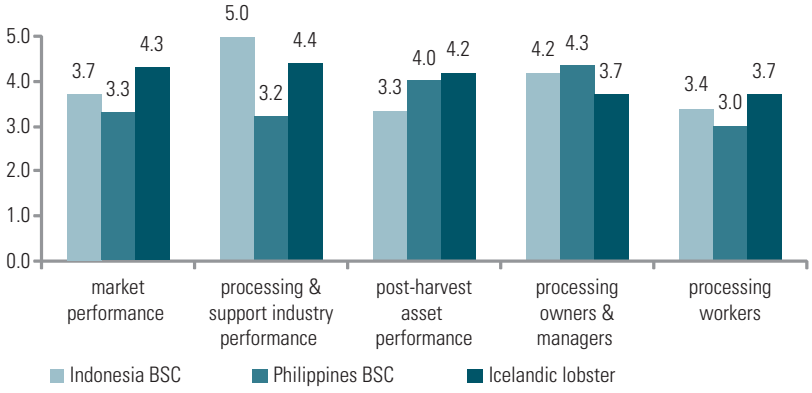
Source: Authors.

FIGURE 3.23: Summary of Processing Workers



Source: Authors.

FIGURE 3.24: Summary of Post-Harvest Sector Performance



Source: Authors.

TABLE 3.12: Summary of FPIs' Output Results

	COMPONENT	INDONESIA BSC	PHILIPPINES BSC	ICELANDIC LOBSTER
FPIs' Output	Ecologically Sustainable Fisheries	1.8	1.3	4.8
	Harvest Sector Performance	3.2	3.2	4.6
	Post-Harvest Performance	3.9	3.6	4.1

Source: Authors.

Chapter 4: FPIs' APPLICATION ON BSC FISHERIES—*INPUTS* RESULTS

This chapter will focus on the enabling factors that contribute either the success or the failure of the fisheries.

4.1 MACRO FACTORS

The **Macro Factors** take advantage of the existing indicators from other sources to capture the *General Environmental Performance, Economic Condition,* and *Governance*. It also includes *Exogenous Environmental Factors* to capture any exogenous shocks. More details are presented as follows.

4.1.1 General Environmental Performance—Country Level

The *General Environmental Performance* uses the Environmental Performance Index (EPI) developed by researchers from Yale University and Columbia University (EPI 2011). The EPI tracks 10 policy categories covering both environmental public health and ecosystem vitality. It has been revisited biannually since 2006. The score system is defined in table 4.1.

In 2010, Iceland achieved the highest score (93.6). Indonesia and the Philippines scored 44.6 and 65.7, respectively. Therefore, the *General Environmental Performance* scores for Iceland, Indonesia, and the Philippines were 5, 3, and 4, respectively (figure 4.1).

4.1.2 Governance—Country Level

The governance indicator uses the World Bank's Worldwide Governance Indicators (WGI), which is updated annually since 2002 (World Bank 2011a). It consists of six dimensions. FPIs regroup them into two categories: *Governance Indicator—Effectiveness*, taking the average of Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), and Control of Corruption indicators (CC) (four out of six dimensions); and *Governance Indicator—Accountability*, taking the average of Voice and Accountability and Political Stability indicators (two out of six dimensions). The score system is shown in table 4.2.

Indonesia and the Philippines received 2 or 3 for these two indicators, indicating the general perceptions regarding the stability, public services, ability to implement sound policies, confidence in the quality of property rights, and corruption situation in these two countries could be greatly improved (figure 4.2).

4.1.3 Economic Condition—Country Level

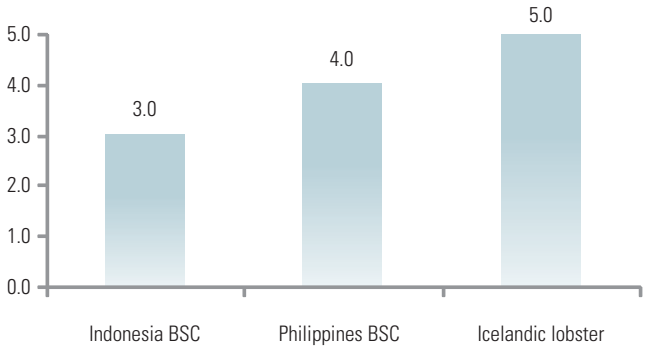
The economic condition is composed of two economic indicators. One is the *Index of Economic Freedom* (IEF) developed by The Heritage Foundation and *The Wall Street Journal* to evaluate 10 components of freedom, such as business freedom, investment freedom, trade freedom, labor freedom, financial freedom, and so on (table 4.3). Another is

TABLE 4.1: Score System for General Environmental Performance

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
General Environmental Performance	• **5**: EPI of 81–100 • **4**: 61–80 • **3**: 41–60 • **2**: 21–40 • **1**: 1–20	The EPI considers factors such as disease, water quality, air pollution, biodiversity, natural resources, and climate change. The EPI ranges from 1–100.

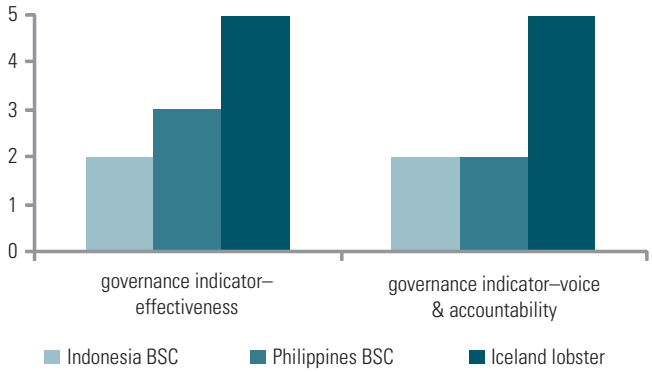
Source: Anderson and Anderson 2010.

FIGURE 4.1: General Environmental Performance



Source: Authors.

FIGURE 4.2: Country-Level Governance



Source: Authors.

TABLE 4.2: Score System for Governance—Country Level

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Governance Indicator—Effectiveness	• **5**: 1st quintile • **4**: 2nd • **3**: 3rd • **2**: 4th • **1**: 5th	The Governance Indicators (Kaufman, Kraay, and Mastruzzi 2008) assign countries to ranks based on six dimensions. This measure is the average percentile ranking of the (1) Government Effectiveness, (2) Regulatory Quality, (3) Rule of Law, and (4) Control of Corruption indicators (four out of six dimensions). Assign average percentile to a quintile and give points according to the left criteria.
Governance Indicator—Voice and Accountability	• **5**: 1st quintile • **4**: 2nd • **3**: 3rd • **2**: 4th • **1**: 5th	The Governance Indicators (Kaufman, Kraay, and Mastruzzi 2008) assign countries to ranks based on six dimensions. This measure is the average percentile ranking of the (1) Voice and Accountability and (2) Political Stability indicators (two out of six dimensions). Assign average percentile to a quintile and give points according to the left criteria.

Source: Anderson and Anderson 2010.

TABLE 4.3: Index of Economic Freedom (IEF), 2011

	THE PHILIPPINES	INDONESIA	ICELAND	AVERAGE
Government Spending	91.0	88.9	0.0	63.9
Fiscal Freedom	78.8	83.0	69.8	76.3
Trade Freedom	77.8	73.8	88.2	74.8
Monetary Freedom	76.3	74.3	68.6	73.4
Labor Freedom	50.7	51.8	60.7	61.5
Financial Freedom	50.0	40.0	60.0	48.5
Business Freedom	43.4	54.9	92.7	64.3
Investment Freedom	40.0	35.0	65.0	50.2
Property Rights	30.0	30.0	90.0	43.6
Freedom from Corruption	24.0	28.0	87.0	40.5

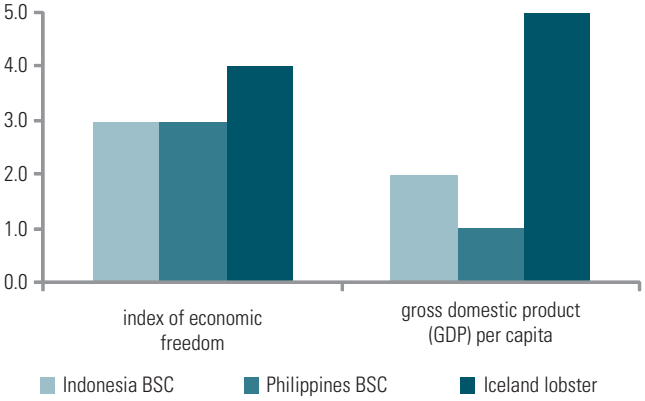
Source: http://www.heritage.org/index/ranking.

TABLE 4.4: Score System for Economic Conditions—Country Level

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Index of Economic Freedom (IEF)	• **5**: IEF of 81–100 • **4**: 61–80 • **3**: 41–60 • **2**: 21–40 • **1**: 1–20	The 10 factors are equally weighted and the final composite index has a range from 1 to 100. A detailed discussion of these factors and methodology is found in Miller and Holmes (2009).
Gross Domestic Product (GDP) Per Capita	• **5**: Greater than US$30,000 • **4**: Greater than US$12,400 • **3**: Greater than US$6,000 • **2**: Greater than US$2,500 • **1**: Less than US$2,500	Bin boundaries based on quintiles of the U.S. CIA's rank of per capita GDP of all countries (https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html).

Source: Anderson and Anderson 2010.

FIGURE 4.3: Economic Condition



Source: Authors.

Gross Domestic Product Per Capita based on the data from the World Bank to evaluate the general wealth situation of a particular country (World Bank 2011b). The score system is shown in table 4.4.

Iceland has good macro conditions on these two indicators (figure 4.3). Both Indonesia and the Philippines are in the mid-range in terms of economic freedom but are relatively low for GDP per capita. The Philippines and Indonesia obtained 56.2 and 56 for IEF. Both face serious limitations resulting from corruption, weak property rights, and investment freedom. Iceland faces serious issues associated with government spending and fiscal and monetary policy (table 4.3). Iceland is one of the wealthiest countries in the world with per capita GDP of nearly $40,000 per year. The GDP in Indonesia is $3,039 per year, and the Philippines GDP is $2,132 per year.

4.1.3.1 Comments

- This group of macroeconomic indicators seems to adequately characterize the general economic and environmental conditions. This macro environment will affect the success of fishery management. It is important to understand all these macro constraints when designing fishery policies.

4.1.4 Exogenous Environmental Factors—Country Level

This group of indicators on **Exogenous Environmental Factors** adds a new dimension on the macro factors to capture the impact of exogenous environmental shocks. It includes five different aspects, *Disease and Pathogens*, *Natural Disasters and Catastrophes, Pollution Shocks and Accidents, Level of Chronic Pollution (A),* and *Level of Chronic Pollution (B)* (table 4.5).

These three fisheries are not affected by chronic pollution, disease, and pathogens (figure 4.4). The BSC harvests in Indonesia and the Philippines are reduced by 10 to 30 percent due to natural disasters and catastrophes. Additionally, the BSC harvest in Indonesia is affected by pollution shocks and accidents. This means that even if Indonesia has better fishery management, they still need to pay attention to other sectors and the corresponding impact on the fishery.

4.1.4.1 Comments

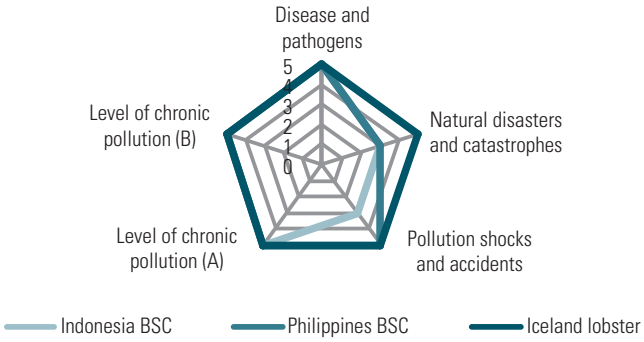
- These indicators adequately characterize the general exogenous environmental factors and their impact on the stock and consumption.
- For *Pollution Shocks and Accidents*, it is suggested to add "piracy" as this has become an issue for West Indian Ocean fisheries.

TABLE 4.5: Score System for Exogenous Environmental Factors

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Disease and Pathogens	• **5**: Harvest unaffected by disease • **4**: Harvest reduced by less than 10% • **3**: Harvest reduced by less than 10–30% • **2**: Harvest reduced by more than 30% • **1**: Harvest almost completely closed by shocks	
Natural Disasters and Catastrophes	• **5**: Harvest unaffected by disaster • **4**: Harvest reduced by less than 10% • **3**: Harvest reduced by less than 10–30% • **2**: Harvest reduced by more than 30% • **1**: Harvest almost completely closed by shocks	
Pollution Shocks and Accidents	• **5**: Harvest unaffected by pollution • **4**: Harvest reduced by less than 10% • **3**: Harvest reduced by less than 10–30% • **2**: Harvest reduced by more than 30% • **1**: Harvest almost completely closed by shocks	
Level of Chronic Pollution (A)	• **5**: Not detectable • **4**: Minimal detectable levels • **3**: Major detectable levels • **2**: Pollution affects stock growth • **1**: Pollution leading to severe stock decline	
Level of Chronic Pollution (B)	• **5**: No consumption affected • **4**: Minimal consumption affected • **3**: Official consumption advisories • **2**: Temporarily ban harvest for consumption • **1**: Completely closed for consumption	

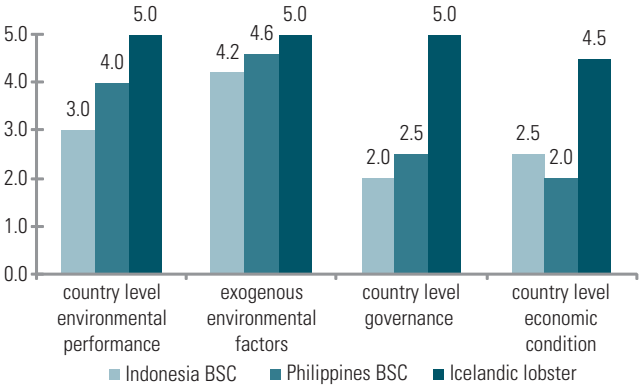
Source: Anderson and Anderson 2010.

FIGURE 4.4: Exogenous Environmental Factors



Source: Authors.

FIGURE 4.5: Summary of Macro Factors



Source: Authors.

- For the *Level of Chronic Pollution*, it is suggested to add "stock effect" and "consumption effect" at the end of each indicator to distinguish each other instead of using "A" and "B" (see Appendix B).

4.1.5 Summary

In summary, the Icelandic lobster fishery is located in a country with generally high-performing macro factors. Indonesia and the Philippines have substantial room for improvement in governance effectiveness and economic conditions (figure 4.5). None of them experienced severe exogenous environmental shocks.

TABLE 4.6: Score System for Access Rights

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Proportion of Harvest Managed Under Limited Access	• **5**: Virtually all • **4**: 71–95% • **3**: 36–70% • **2**: 5–35% • **1**: Virtually none	The proportion of total harvest that is under limited-access fishing regulation.
Transferability Index	• **5**: Very Strong: Fully transferable through well-established, efficient market institutions • **4**: Strong: Fully transferable, but institutions are poor or illiquid • **3**: Moderate: Transferable, but with severe restrictions on who can hold, or how much • **2**: Weak: Transferable only under highly restricted and limited condition • **1**: Access rights not transferable	
Security Index	• **5**: Very Strong: Access rights are completely respected and are not diluted (e.g., by issuing more access rights) by the government • **4**: Strong: Rights are mostly respected by the government; generally survive changes in government administration • **3**: Moderate: Rights are at risk of retraction or dilution with changes in administration • **2**: Weak: Rights are highly diluted or there is high political uncertainty • **1**: None: Access rights are not protected	Extent to which the government reduces or dilutes the access rights.
Durability Index	• **5**: Very Strong: More than 10 years to perpetuity • **4**: Strong: 6 to 10 years • **3**: Moderate: 1 to 5 years • **2**: Weak: Seasonal • **1**: None: None/daily	Duration of the property right.
Flexibility Index	• **5**: Very Strong: All decisions on time of harvest, gear used, and handling practices are in the owner's control • **4**: Strong: Minimal restrictions on time of harvest and technology • **3**: Moderate: Modest restrictions on time of harvest and technology • **2**: Weak: Significant restrictions on time of harvest and technology • **1**: Time of harvest, gear used, and handling practices are not in the owner's control	Ability of right holders to be flexible in the timing and production technology employed.
Exclusivity Index	• **5**: Very Strong: All decisions and access to the property are controlled by the right's owner (rather than those without rights, competing resource users [like recreational or by-catch fisheries]) • **4**: Strong: Little intrusion on resource by those without rights • **3**: Moderate: Modest intrusion on resource by those without rights • **2**: Weak: Significant intrusion on resource by those without rights • **1**: None: Completely unrestricted open access, despite putative right	Ability of right holders to exclude those who do not have the right from affecting the resource or market

Source: Anderson and Anderson 2010.

4.2 PROPERTY RIGHTS AND RESPONSIBILITY

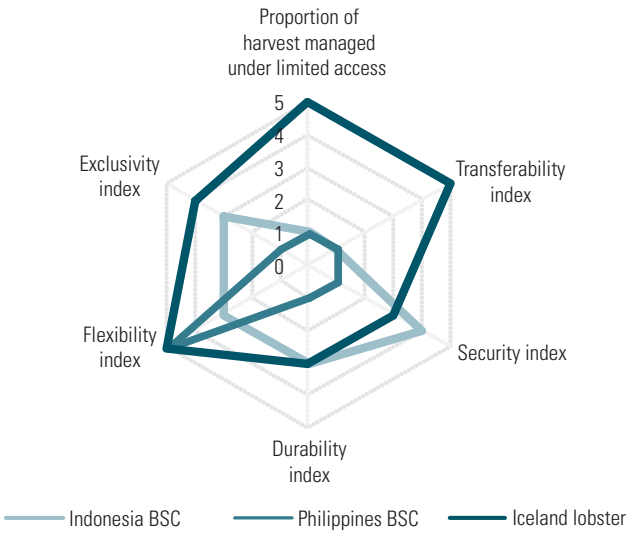
The **Property Rights and Responsibilities** component consists of *Access Rights*, *Harvest Rights,* and *Collective Action*. *Access Rights* and *Harvest Rights* are different. *Access Rights* define the rights to access the fishery, which focus on accessibility. *Harvest Rights* explicitly convey rights to a specific share or quota of quantity of the harvest. These groups of indicators shed light on the characteristics of these rights.

4.2.1 Access Rights

Access Rights is the average of six indicators, including *Proportion of Harvest Managed under Limited Access, Transferability Index, Security Index, Durability Index, Flexibility Index,* and *Exclusivity Index*. The score system is illustrated in table 4.6.

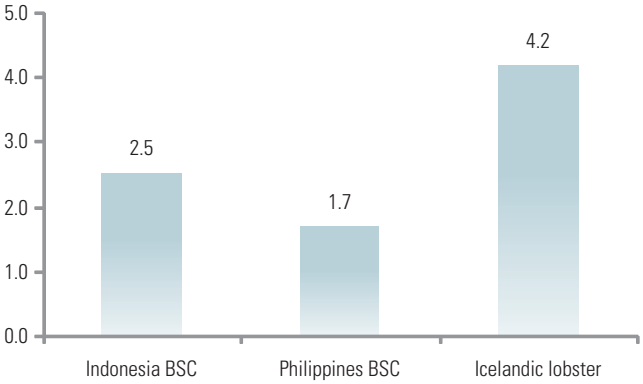
The subindicators for *Access Rights* reflect the basic characteristics of any property rights, such as exclusivity, transferability, security, durability, and flexibility. Icelandic lobster fishery achieved high scores on transferability (5) and flexibility (5) but needs substantial improvement on security (3) and durability (3). Both Indonesia and the Philippines BSC fisheries operate under an open access regime. There are no formally defined access rights (there are elements of implicit access rights by tradition) and basically anyone can go fishing whenever they want to. The Philippines BSC fishery has no

FIGURE 4.6: Asset Rights



Source: Authors.

FIGURE 4.7: Summary of Asset Rights



Source: Authors.

formally defined access rights but received score 5 on the *Flexibility Index* because there are no constraints on timing, gear, or handling (figure 4.6).

Indonesia has some management in place (e.g., registration), resulting in weak access rights. Vessels of less than 10 GT are managed by the district. The provinces deal with vessels between 10 and 30 GT, and larger vessels are managed on the national level. The local authorities are in charge of managing the BSC fisheries as most crab fishermen use no motor or motors under 5 GT. Without national policy or guidance, there are considerable differences in management throughout the country. Some district governments recently took initiative to monitor the licensed small-scale vessels (<10 GT), including those used in the BSC fishery. In some areas the fishermen have self-organized to control the fishing gear used in this fishery. In some districts the miniplants encourage better handling and pay premium price for high-quality product. All these practices have positively affected the security, durability, exclusivity, and flexibility scores.

As shown in figure 4.7, the Icelandic lobster fishery achieved 4.2, indicating a healthy *Access Rights* in place. Both Indonesia and the Philippines BSC fisheries have substantial room to strengthen their *Access Rights*. The Indonesia BSC fishery needs to limit access and strengthen the asset exclusivity, durability, flexibility, and transferability. The Philippines BSC fishery could strengthen every category of their *Access Rights* except flexibility.

4.2.1.1 Comments

- This group of indicators is clear and easy to understand and score. For fisheries where they do not have access rights, they will score 1 for *Proportion of Harvest Managed Under Limited Access*, but may have high scores for other indicators depending on the situation. Informal management, such as fishing agreement, or community-based management, will affect the score, even without official authority.

4.2.2 Harvest Rights

Similar to the *Access Rights*, *Harvest Rights* measure the same characteristics but on the harvest aspect. The score system is shown in table 4.7.

The Icelandic lobster fishery has strong *Harvest Rights*, but there is still substantial room for strengthening *Security* and *Durability* (figure 4.8). For the Philippines BSC fishery, the *Harvest Rights* essentially do not exist. The Indonesia BSC fishery has no formal *Harvest Rights* either, but because of some management in place there are some weak implicit characteristics of harvest rights.

In summary, the Icelandic lobster fishery has relatively strong *Harvest Rights*. Indonesia and the Philippines BSC fisheries have very weak *Harvest Rights* (figure 4.9). They received average scores of 2.7 and 1.7, respectively, much below the benchmark (3.5). The same as *Access Rights*, the Indonesia BSC fishery needs to set up total allowable catch (TAC) and strengthen the harvest exclusivity, durability, flexibility, and transferability. The Philippines BSC fishery could strengthen every category of their *Harvest Rights* except flexibility.

4.2.2.1 Comments

- The *Harvest Rights* indicators seem to adequately reflect the characteristics of these fisheries in terms of harvest share or quota system. They are clearly defined and easy to score.

TABLE 4.7: Score System for Harvest Rights

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Proportion of Harvest Managed with Rights-Based Management	• **5**: Virtually all • **4**: 71–95% • **3**: 36–70% • **2**: 5–35% • **1**: Virtually none	The proportion of total harvest that is under rights-based fisheries management (e.g., Individual or Community Quotas, Catch Shares or Territorial Use Rights [TURFs]).
Transferability Index	• **5**: Very Strong: Fully transferable through well-established, efficient market institutions • **4**: Strong: Fully transferable, but institutions are poor or illiquid • **3**: Moderate: Transferable, but with severe restrictions on who can hold, or how much • **2**: Weak: Transferable only under highly restricted and limited conditions • **1**: Access rights not transferable	
Security Index	• **5**: Very Strong: Harvest rights are completely respected and are not diluted (e.g., by issuing more access rights) by the government • **4**: Strong: Rights are mostly respected by the government; generally survive changes in government administration • **3**: Moderate: Rights are at risk of retraction or dilution with changes in administration • **2**: Weak: Rights are highly diluted or there is high political uncertainty • **1**: None: Harvest rights are not protected	Extent to which the government reduces or dilutes the access rights.
Durability Index	• **5**: Very Strong: >10 years to perpetuity • **4**: Strong: 6 to 10 years • **3**: Moderate: 1 to 5 years • **2**: Weak: Seasonal • **1**: None: None/daily	Duration of the property right.
Flexibility Index	• **5**: Very Strong: All decisions on time of harvest, gear used, and handling practices are in the owner's control • **4**: Strong: Minimal restrictions on time of harvest and technology • **3**: Moderate: Modest restrictions on time of harvest and technology • **2**: Weak: Significant restrictions on time of harvest and technology • **1**: Time of harvest, gear used, and handling practices are not in the owner's control	Ability of right holders to be flexible in the timing and production technology employed.
Exclusivity Index	• **5**: Very Strong: All decisions and access to the property are controlled by the right's owner (rather than those without rights, competing resource users [like recreational or by-catch fisheries]) • **4**: Strong: Little intrusion on resource by those without rights • **3**: Moderate: Modest intrusion on resource by those without rights • **2**: Weak: Significant intrusion on resource by those without rights • **1**: None: Completely unrestricted open access, despite putative right	Ability of right holders to exclude those who do not have the right from affecting the resource or market.

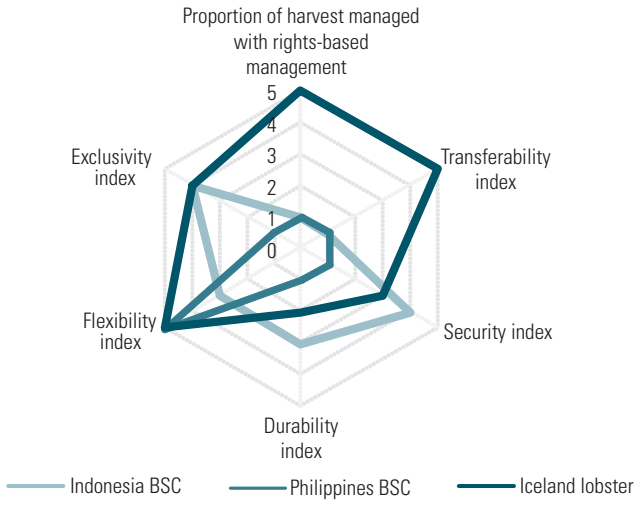
Source: Anderson and Anderson 2010.

4.2.3 Collective Action

The *Collective Action* is the average of three indicators, including *Participation in Harvester Organizations, Harvester Organization Influence on Fishery Management and Access,* and *Harvest Organization Influence on Business and Marketing* (table 4.8). This group of indicators measures how the local fishing communities participate in the management process.

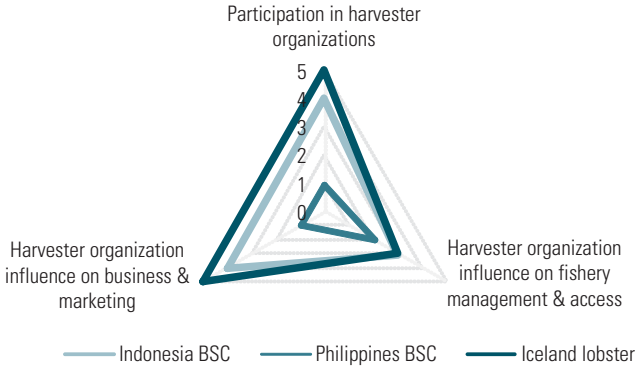
Both Icelandic lobster fishery and Indonesia BSC fishery received higher scores than the benchmark in *Participation in Harvester Organizations* and *Harvester Organization Influence on Fishery Management and Access* (figure 4.10). The stakeholders in Indonesia are proactive, partially because of the establishment of Indonesia Blue Swimming Crab Processing Association (APRI). APRI consists of 11 processing companies and exporters, representing over 90 percent of all crab exported from Indonesia to the U.S. market. Currently, APRI, along with Sustainable Fisheries Partnership (SFP) have a joint Fisheries Improvement Project (FIP) that has been partly implemented in order to address the deficiencies identified by the MSC Pre-Assessment report and improve the fishery management to meet MSC standards. APRI has been actively doing collective action in trying to

FIGURE 4.8: Harvest Rights



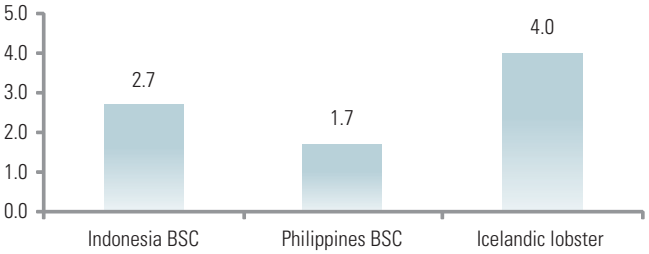
Source: Authors.

FIGURE 4.10: Collective Action



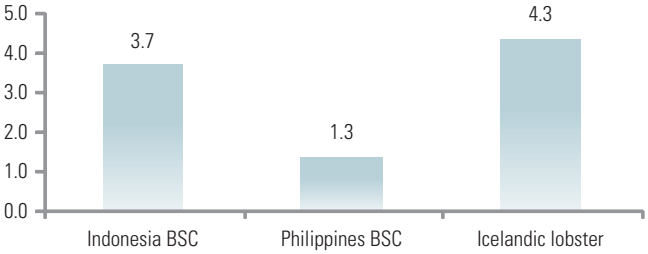
Source: Authors.

FIGURE 4.9: Summary of Harvest Rights



Source: Authors.

FIGURE 4.11: Summary of Collective Actions



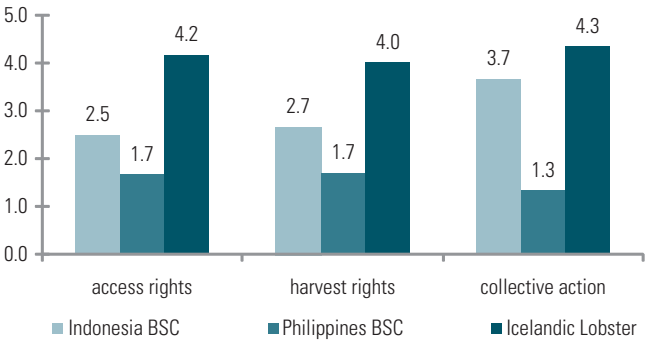
Source: Authors.

TABLE 4.8: Score System for Collective Action

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Participation in Harvester Organizations	• **5**: Virtually all • **4**: 71–95% • **3**: 36–70% • **2**: 5–35% • **1**: Virtually none	Proportion of harvest where the primary harvesters are organized into associations.
Harvester Organization Influence on Fishery Management and Access	• **5**: Harvesters effectively determine allocation of resources • **4**: Harvesters have significant influence in determining allocation • **3**: Harvesters are politically active but not controlling • **2**: Social or informal monitoring participation and allocation • **1**: No active effort or capacity to influence management	Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on management and access to the fishery.
Harvester Organization Influence on Business and Marketing	• **5**: Harvesting organizations cooperatively determine marketing and operational details • **4**: Extensive joint marketing • **3**: Large subgroups facilitating marketing; joint purchasing • **2**: Small subgroups cooperating in purchasing or operations • **1**: No active effort or capacity to influence business operations	Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on management and access to the fishery.

Source: Anderson and Anderson 2010.

FIGURE 4.12: Summary of Property Rights



Source: Authors.

influence the government and market to improve the sustainability of the fishery.

In the Philippines, the local communities have virtually no influence in the management process, indicated by the low scores in figure 4.11. Because the fishing ground for the BSC fisheries is within the municipal waters (15 km from the shoreline), the jurisdiction is under the local government units (LGUs). There was no management system in place in most areas, leading weak rights and low participation. Management and regulation of the fisheries are therefore dependent heavily on the initiative of the LGU's Elected Administrators and law-makers. Awareness of marine resources protection is very high, particularly on coastal habitats and lesser on fisheries. Recently, the Philippines government has drafted fishery management plan for BSC fishery.

In summary, both the Icelandic lobster fishery and the Indonesian BSC fishery are characterized by a high level of stakeholder involvement, with average scores of 3.7 and 4.3, respectively. However, they both need to improve their influence on fishery management and access. The Philippines BSC fishery needs to substantially strengthen their stakeholders' participation in every aspect.

4.2.3.1 Comments

- The *Collective Actions* indicators are clear and easy to score. They adequately reflect the degree of stakeholders' participation.

4.2.4 Summary

In summary, Icelandic lobster adopted an Individual Transferable Quota (ITQ) system and therefore has strong property rights, reflected in strong *Access Rights* and *Harvest Rights* (figure 4.12). Both the Philippines and Indonesia BSC have considerable opportunity to strengthen their property rights. Without institutions for well-defined rights, responsibility and participation improvements in other areas can be undermined.

4.3 MANAGEMENT

Management consists of three dimensions, Management Inputs, Data Management, and Participation.

4.3.1 Inputs

Management Inputs is the average of five indicators, including *Management Expenditure to Value of Harvest, Management Employees to Value of Harvest, Management Employees per Permit Holder, Research as a Proportion of Fisheries Management Budget,* and *Level of Subsidies* (table 4.9).

The Icelandic lobster fishery obtained full scores for all the management input indicators. Scores correspond to government commitments. However, there may be decreasing returns to scale, so there may be a nonlinear relationship with use of public resources (figure 4.13). The Philippines has virtually no management, subsidies, or research on BSC fisheries, therefore it received high scores for *Management Expenditure to Value of Harvest* and *Level of Subsidies*, and low scores for everything else. Indonesia expert did not score because it was difficult to calculate the number of employees, and expenditures related to the BSC fishery management. However, because the government does not allocate lots of resources on subsidies and research for BSC fishery in Indonesia, it is possible to score *Research as a Proportion of Fisheries Management Budget* and *Level of Subsidies* as 5 based on the score system.

In summary, the Icelandic lobster fishery has correct magnitude of management inputs (figure 4.14). Both the Philippines BSC fishery and Indonesia BSC fishery need to strengthen management inputs. Some positive progress has been made by the Philippines government by drafting and consulting their fishery management plan. In the future, the score will be changed.

4.3.1.1 Comments

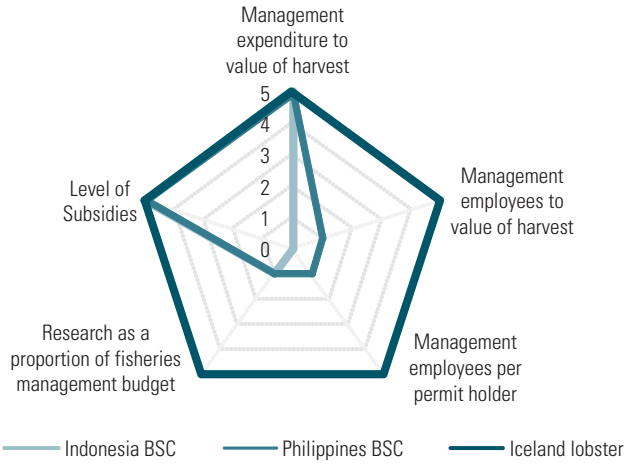
- The main concern is whether this group of indicators is informative and useful enough given the difficulty in accessing the data. *Research as a Proportion of Fisheries Management Budget* can be important because that can provide some basic data about the fisheries and in turn help with policy and decision making. *Level of Subsidies* is important because it will directly affect the harvest cost of fishing and exploitation level and thus sustainability.

TABLE 4.9: Score System for Management Inputs

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Management Expenditure to Value of Harvest	• **5**: Less than 5% of ex-vessel value • **4**: 5–25% • **3**: 26–50% • **2**: 51–100% • **1**: More than the value of harvest	This measure divides the budget (million $) for fisheries management by the ex-vessel value of the harvest.
Management Employees to Value of Harvest	• **5**: More than 0.35 per million • **4**: 0.26–0.35 • **3**: 0.16–0.25 • **2**: 0.01–0.15 • **1**: 0	Public sector fishery management employee FTEs devoted to managing the fishery divided by the ex-vessel value of the harvest.
Management Employees per Permit Holder	• **5**: 4 or more per 100 permit holders • **4**: 3 per 100 permit holders • **3**: 2 per 100 permit holders • **2**: 1 per 100 permit holders • **1**: 0	Fishery management FTE employees divided by the number of fishing units (in 100s) (vessels or permit holders).
Research as a Proportion of Fisheries Management Budget	• **5**: Over 20% • **4**: 11–20% • **3**: 6–10% • **2**: 0.5–5% • **1**: Virtually none	Research expenditures divided by total fisheries management budget.
Level of Subsidies	• **5**: Near zero (less than 2.5%) • **4**: 2.5–7.5% • **3**: 7.6–12.5% • **2**: 12.6–20% • **1**: More than 20%	Measure the annual value of all subsidies as a proportion of the value of the fishery.

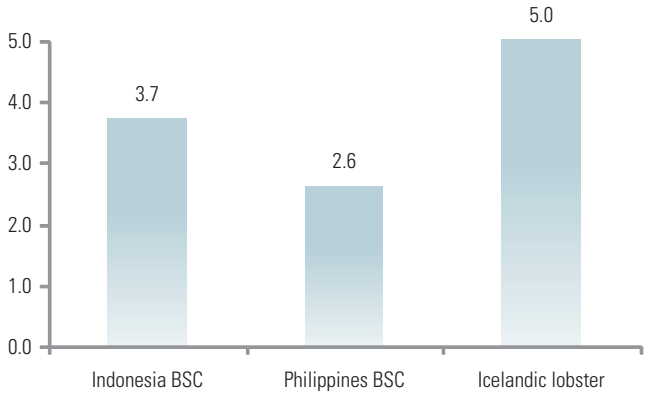
Source: Anderson and Anderson 2010.

FIGURE 4.13: Management Inputs



Source: Authors.

FIGURE 4.14: Summary of Management Inputs



Source: Authors.

- To make it easier to score for *Management Expenditure to Value of Harvest*, it is suggested to change the definition to "Government, industry and aid agency expenditures on fishery management activities including research, enforcement, and management capacity development (but not infrastructure)" (see Appendix B).
- *Management Employees to Value of Harvest* and *Management Employees per Permit Holder* can be tricky and difficult to score, especially for a single fishery when the management employees have to deal with multiple species. It is suggested to delete these two indicators (see Appendix B).
- Additionally, enforcement has been a common issue for many developing countries' fisheries. They often have rules but lack enforcement. Therefore, it is

suggested to add *Enforcement Capacity* as one indicator in *Management Input* (see Appendix B).

- For many fishery species, it is hard to avoid the transboundary issue. Whether there is an effective regional coordination will affect the success of one country's fishery management. It is suggested to add *Management Jurisdiction* to capture this issue (see Appendix B).

4.3.2 Data Management

The dimension of *Data Management* is composed of *Data Availability* and *Data Analysis* (table 4.10). For many countries, lack of data collection and analysis is common, which directly affects the effectiveness of management. The idea of including these indicators is to promote the proper data collection system.

According to the FPIs evaluation, the Icelandic lobster fishery collects and fully utilizes data (figure 4.15). The Indonesia BSC fishery has some data, but not enough analysis for decision making. The Philippines BSC fishery has very limited data from the government. However, universities have studied the BSC population and have some measurement of MSY, biological parameters, and even genetic stocks. There is still substantial room for improvement in this category.

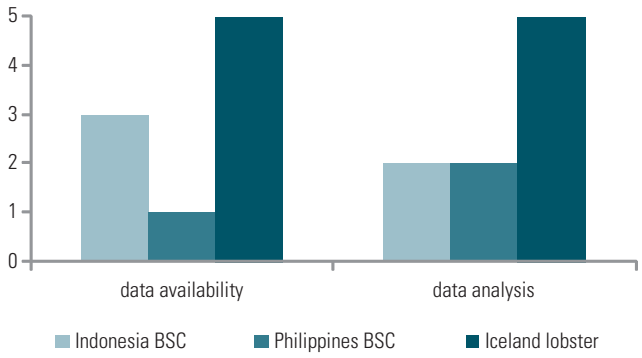
4.3.2.1 Comment

- These two data indicators are simple, clear, and easy to score.

4.3.3 Participation

The *Participation* dimension is the average of *Days in Stakeholder Meetings* and *Industry Financial Support for Management*. The score system is illustrated in table 4.11.

FIGURE 4.15: Data Management



Source: Authors.

The Icelandic lobster fishery industry has put financial support for the fishery management, accounting over half of the fishery management budget, but the people who are active in management only spend less than 5 days in stakeholder meetings per year (figure 4.16). Both Indonesia and the Philippines BSC industries give virtually no support for fishery management. The participation of the stakeholder meetings in Indonesia BSC fishery management is slightly higher than that in the Philippines but still less than one day a month.

4.3.3.1 Comment

- These two data indicators are simple, clear, and easy to score.

4.3.4 Summary

In summary, the Icelandic lobster fishery has considerable management inputs and data collection, but with limited participation (figure 4.17). Management inputs for Philippines BSC fishery are minimal. Both data collection and

TABLE 4.10: Score System for Data Management

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Data Availability	• **5**: Regular stock assessment and economic data available • **4**: Landings and price data available • **3**: Only landing data available • **2**: Only boat registration and license data available • **1**: No data is tracked	
Data Analysis	• **5**: Biological and economic data used in prospective analysis of management • **4**: Biological data dominate simple prospective analysis • **3**: Biological or economic data are used to track performance retrospectively • **2**: Data are used inconsistently or irregularly • **1**: No data analysis conducted in management process	

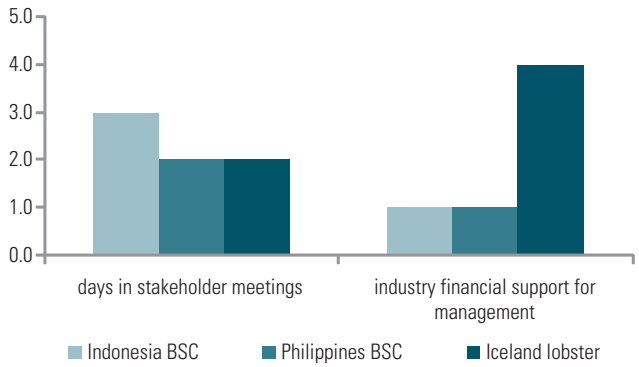
Source: Anderson and Anderson 2010.

TABLE 4.11: Score System for Participation

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Days in Stakeholder Meetings	• **5**: More than 24 days per year • **4**: 12–24 • **3**: 6–11 • **2**: 1–5 • **1**: None	Days in stakeholder meetings per year spent by a participant in the fishery who is active in management.
Industry Financial Support for Management	• **5**: Virtually all • **4**: 51–95% • **3**: 6–50% • **2**: 1–5% • **1**: None	Proportion of the fishery management budget paid for by the fishing sector.

Source: Anderson and Anderson 2010.

FIGURE 4.16: Participation



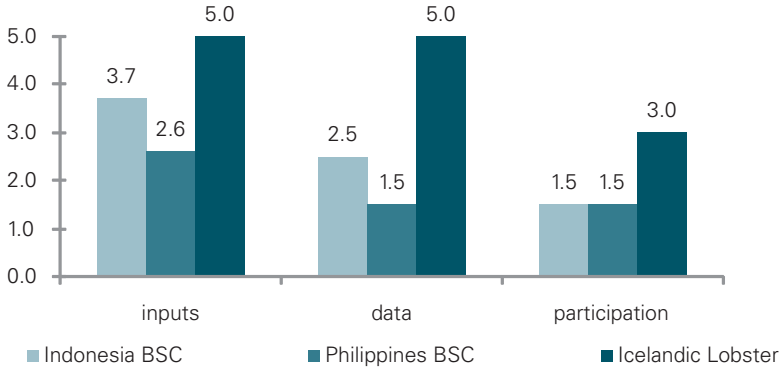
Source: Authors.

participation in the Philippines and Indonesia BSC fisheries are very low.

4.3.4.1 Comments

- Leadership and social cohesion were left out in the FPIs. Considering the importance of these two aspects, it is suggested to add a new dimension, called *Community* which includes Leadership and Social Cohesion into the FPIs (see Appendix B).
- Gender is another dimension that has not been included. Women can play an important role in different aspects, but the role of women as pure work labor will be different from the role of women as business managers or policy makers. Therefore, it is suggested to add a group of indicators related to gender by examining the role and degree of women's influence in harvest, post-harvest, and management.
- With new indicators, it is suggested to restructure the indicators by adding a new component **Co-Management** separate from **Management**. **Co-Management** will include *Collective Action, Participation, Community,* and *Gender* (see Appendix B).
- Under Management, it is also suggested to add another dimension on Management Methods, including *MPAs and Sanctuaries, Spatial Management,* and *Fishing Mortality Limits*, to measure whether different management methods are in place to protect the

FIGURE 4.17: Summary of Management



Source: Authors.

critical spawning area and period, spatial access rights, and mortality control. See Appendix B for detailed definition and scale for each of them.

4.4 POST-HARVEST INPUTS

The **Post-Harvest Inputs** component includes two dimensions, *Market and Market Institutions* and *Infrastructure*, to measure the economic and physical infrastructure availability for sustainable wealth creation.

4.4.1 Market and Market Institution

The ability to access competitive, free markets will give buyers and sellers an unbiased and efficient price. This is essential for participants to allocate resources efficiently. A well-established market with a transparent pricing system will facilitate the success of this sector. *Market and Market Institution* is the average of *Landings Pricing System, Availability of Ex-Vessel Price and Quantity Information, Number of Buyers, Degree of Vertical Integration, Level of Tariffs,* and *Level of Nontariff Barriers* (table 4.12).

Nontariff barriers are not a major factor in any of these three fisheries (figure 4.18). Iceland sells their lobster to the EU market with virtually no tariff, much lower than the 15 percent tariff both Indonesia and the Philippines have to pay when exporting to the United States. However, Icelandic lobsters are purchased by a small number of coordinated buyers, less competitive than the BSC market. In Indonesia, the miniplant will follow wherever the boat lands and buy all the crabs captured at the competitive beach prices with subtraction of transportation cost. Because of the high demand, it is difficult to get enough raw materials, the processing companies are competing to get the products from miniplants. Most of the companies sent their field staff to ensure they have enough supply from miniplants. Regarding the vertical integration, the Indonesia BSC fishery scored 3, the Icelandic lobster fishery scored 2 and the Philippines BSC fishery scored 1. This is because most miniplants belong to the processor/exporter from the beginning. They were built and set up to supply specific exporters/processors. Miniplants have been strengthened during the past several years and have become very important players in the crab business. Now most of the miniplants are operating independently and do not have any obligation to supply to any specific processing companies. The *Availability of Ex-Vessel Price and Quantity Information* is still not transparent in both Indonesia and the Philippines. The fishermen rarely depend on the miniplant for the price information.

In summary, the Icelandic lobster fishery just meets the benchmark. Both Indonesia and the Philippines BSC fisheries perform below the benchmark, particularly the Philippines BSC fishery has substantial opportunities for improvement in terms of price, information sharing, and export conditions (figure 4.19).

4.4.1.1 Comments

- This group of indicators is clearly identified and easy to score. They adequately reflect the Post-Harvest inputs in each fishery.

4.4.2 Infrastructure

Good infrastructure is essential for successful business as it can help reduce the production and transportation cost. The FPIs measure a few key aspects of infrastructure related to fisheries business. *Infrastructure Input* is the average of *International Shipping Service, Road Quality Index, Technology Adoption, Extension Service, Reliability of Utilities/Electricity,* and *Access to Ice and Refrigeration* (table 4.13).

Iceland has good infrastructure to support the fishery business (figure 4.20). Indonesia BSC has relatively good international shipping, ice access, and reliability of utilities, but the road quality, extension service, and technology adoption require substantial improvement. Regarding *Extension Service*, Indonesia expert scored this indicator as 1 because there was no extension service provided by the government. All the trainings are provided by the processors/exporters. The Philippines expert thought any kind of extension service counted, so this indicator scored 2. In Indonesia, ocean/air shipping is readily available. Cell phone is the main equipment for the field manager to get the raw material from the miniplant. Regarding the *Reliability of Utilities/Electricity*, most of the processing facilities have generators as backup for electricity outage in Indonesia. But in the Philippines, only some picking plants and pasteurizing plants can afford large generators. With better *Technology Adoption* ability, more *Reliable Utilities/Electricity* and *Ice Supply*, Indonesia is more prepared for international trade. Both Indonesia and the Philippines need to improve their road quality as this will affect their transportation cost and competitiveness in the business.

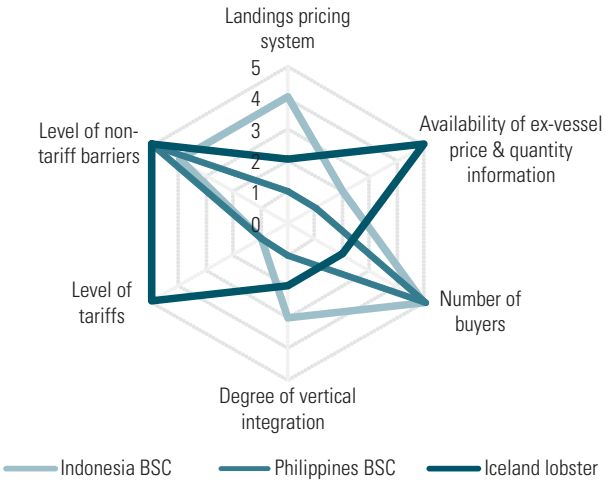
In summary, the Icelandic lobster fishery has the best infrastructure to support (figure 4.21). The Indonesia BSC fishery just meets the benchmark criteria, and the Philippines BSC fishery needs to improve the infrastructure for every dimen-

TABLE 4.12: Score System for Market and Market Institution

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Landings Pricing System	• **5**: Virtually all • **4**: 71–95% • **3**: 36–70% • **2**: 5–35% • **1**: Virtually none	Proportion of the harvest sold in a transparent daily competitive pricing mechanism, such as an auction or centralized ex-vessel to wholesale market.
Availability of Ex-Vessel Price and Quantity Information	• **5**: Complete, accurate price and quantity information available to market participants immediately • **4**: Reliable price and quantity information is available prior to the next market clearing • **3**: Price information is available but no timely quantity information • **2**: Price and quantity information are inaccurate, lagged, or available to only a few • **1**: No information available	
Number of Buyers	• **5**: Highly competitive • **4**: 4–6 buyers • **3**: 2–3 competing buyers • **2**: A small number of coordinating buyers • **1**: There is one buyer	Typical number of buyers of ex-vessel product in a given market.
Degree of Vertical Integration	• **5**: Virtually all • **4**: 71–95% • **3**: 36–70% • **2**: 5–35% • **1**: Virtually none	Proportion of harvest where the primary harvester and primary processor/distributor are the same firm.
Level of Tariffs	• **5**: Virtually none • **4**: 0.5–2.5% • **3**: 2.6–5% • **2**: 6–10% • **1**: Over 10%	Based on quintile once data on an appropriate number of systems are collected. However, initially tariff rate on key seafood exports relative to international average for food commodities.
Level of Nontariff Barriers	• **5**: Are not used to limit international trade • **4**: Have very limited impact on international trade • **3**: Act to impede some international trade • **2**: Act to impede a majority of potential international trade • **1**: Act to effectively impede a significant amount of international trade	Nontariff barriers include quantity restrictions (import quotas), regulatory restrictions, investment restrictions, customs restrictions, and direct government intervention.

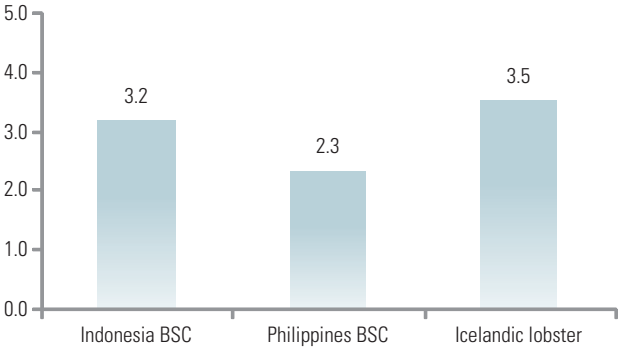
Source: Anderson and Anderson 2010.

FIGURE 4.18: Market and Market Institution



Source: Authors.

FIGURE 4.19: Summary of Market and Market Institution



Source: Authors.

TABLE 4.13: Score System for Infrastructure

MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
International Shipping Service	• **5**: Ocean/Air shipping services are readily available at lower than average rates • **4**: Ocean/Air shipping services are readily available at average rates • **3**: Ocean/Air shipping services are readily available at higher than average rates • **2**: Ocean/Air shipping services are available but irregular • **1**: International shipping is not available at reasonable rates	Average of the two measures (one for ocean shipping and another one for air shipping) on the left.
Road Quality Index	• **5**: High-quality paved roads and extensive highways • **4**: Primarily paved two-lane roads and moderate highway • **3**: Primarily paved two-lane roads and minimal highway • **2**: Paved two-lane roads and well-graded gravel roads • **1**: Poorly maintained gravel or dirt roads	Mile-weighted average road quality between the fishery's primary port and its major consumption center (or export shipping port for exported product). Score according to the left.
Technology Adoption	• **5**: Cell phones/fish finders/computers/processing/production technology are readily available • **4**: Cell phones/fish finders, and so forth, are common, but some other technology is not always available • **3**: Cell phones/fish finders, and so forth, are common, but some other technology is difficult to obtain • **2**: Cell phones are common, but most other technology is prohibitive • **1**: Very little advanced technology is accessible for the industry	
Extension Service	• **5**: Broad extension service with field offices and close linkage with research community • **4**: Extension service with moderate field coverage and adequate linkage with the research community • **3**: Extension service, but with weak links to the research community • **2**: Minimal, poorly supported extension service • **1**: No extension service	
Reliability of Utilities/ Electricity	• **5**: Electricity readily available with rare outages • **4**: Electricity readily available with less than six short outages per year • **3**: Electricity readily available with less than two outages per month • **2**: Electricity readily available with more than two outages per month • **1**: Electricity is not available except through generators	
Access to Ice and Refrigeration	• **5**: Ice is readily available in various forms • **4**: Ice is readily available in various forms with occasional shortages • **3**: Ice is available in limited quantity/form (e.g., block only) • **2**: Ice is available in very limited quantity/form • **1**: Ice is unavailable	

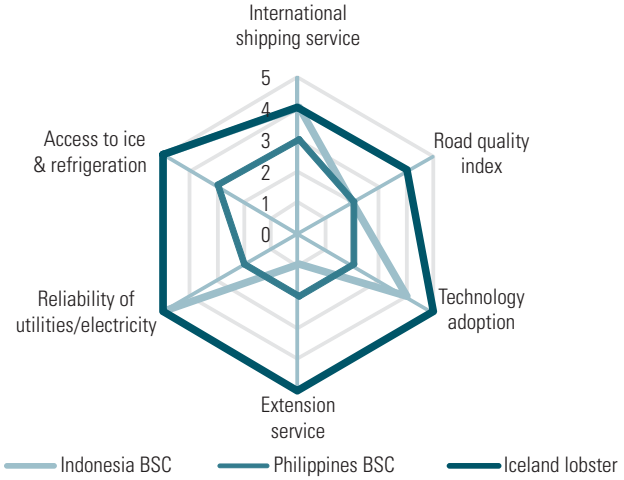
Source: Anderson and Anderson 2010.

sion, including the road, ice supply, electricity, and shipping services.

4.4.2.1 Comments

- *Road Quality Index*: For archipelagic countries, domestic and interisland shipping should also be considered. It is suggested to change the indicator to *Transportation Quality Index* to capture both road and other types of transportation (see Appendix B).
- *Extension Service*: It is suggested to add "private sector initiated extension services" into the explanation (see Appendix B).
- *Reliability of Utilities/Electricity*: For many developing countries, electricity outage is common. The benchmark is more likely for developed countries, and hard to achieve for many developing countries. It is suggested not to use number of outage as the criteria. The suggested scale will be more vague but easy to understand and score, such as 5: Reliable electrical grid provides power in sufficient quantity to prevent product loss; 4: Processors rely on grid, but maintain backup generators; 3: Supply chains rely on own generation capacity; 2: Supply chain sometimes loses product due to condition or irregular fuel supply for generators; 1: Reliable generators or fuel supply not available (see Appendix B).
- *Access to Ice and Refrigeration*: This indicator can add affordability of ice for fishermen and the relative cost of ice compared to the selling price to get a better sense about the ice use situation and understand why

FIGURE 4.20: Infrastructure



Source: Authors.

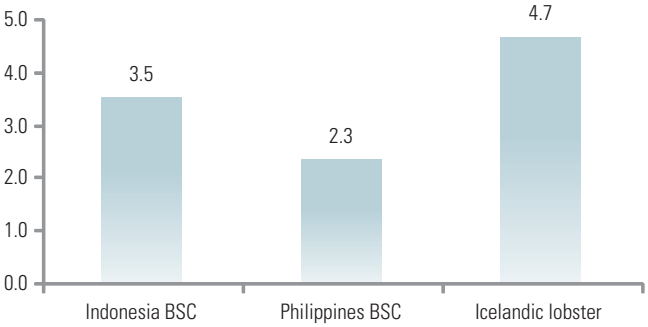
it is not always available or used. It is suggested to revise the indicators to reflect the affordability, such as 5: Ice is available in various forms and in sufficient capacity to support fresh icing of all fish that needs to be iced; 4: Ice is available in various forms, but quantity limits prevent applying to entire catch throughout supply chain; 3: Ice is available in limited form and quantity, and thus applied only to most valuable portions of catch; 2: Ice is available but capacity constrained; ice often reused, or used through melting stage; 1: Ice quantities are extremely limited (see Appendix B).

4.4.3 Summary

In summary, the Post-Harvest Inputs for the Icelandic lobster fishery are characterized as adequate infrastructure, transparent price and quantity information, limited competition on purchasing, and relative low vertical integration (figure 4.22). The Indonesia BSC fishery is characterized as high tariff, lack of price and quantity information, relatively good ice and energy supply, but received low scores on road and extension service. The Philippines BSC fishery is characterized as high tariff, lack of price and quantity information, less competitive purchasing market, primary vertical integration, inadequate ice and energy supply, inadequate road, shipping services, and extension services.

When averaging the score for each of the components discussed above, a summary of FPIs Input Factor results can be obtained (table 4.14), which provides a picture of the input factors. In all, the Icelandic lobster fishery has high inputs.

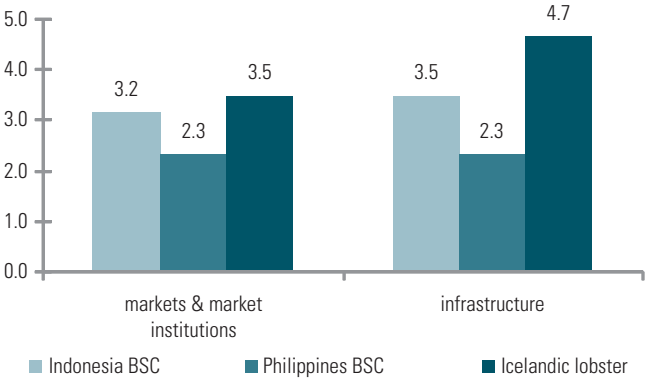
FIGURE 4.21: Summary of Infrastructure



Source: Authors.

The Indonesia BSC fishery has better post-harvest inputs but fewer inputs on the management and property rights aspects besides a relatively weak macro environment. The Philippines BSC fishery has a slightly better macro environment but limited inputs on every other aspects, including property rights, management, and post-harvest inputs.

FIGURE 4.22: Summary of Post-Harvest



Source: Authors.

TABLE 4.14: Summary of FPIs' Output Results

	COMPONENT	INDONESIA BSC	PHILIPPINES BSC	ICELANDIC LOBSTER
FPIs Input	Macro Factors	2.9	3.3	4.9
	Property Rights and Responsibility	2.9	1.6	4.2
	Management Inputs	2.6	1.9	4.3
	Post-Harvest Inputs	3.3	2.3	4.1

Source: Authors.

Chapter 5: CONCLUSIONS

5.1 REGARDING THE STUDIED FISHERIES

The results of FPIs for the Indonesia BSC and the Philippines BSC fisheries, along with the comparison with Icelandic lobster fishery give a clear picture regarding the governance, social, economic, and ecological situation in these fisheries. Three critical benchmarks have been presented. One benchmark is the score of 3.5. Any score under 3.5 indicates a substantial improvement potential. One benchmark is the score of 2. Any score under 2 indicates a warning sign. Emergent actions need to be taken. The third benchmark is another fishery, such as the Icelandic lobster fishery in this case. The following summarizes the results for both output indicators and input indicators.

Figure 5.1 illustrates the average scores for the wealth indicators. The **Icelandic lobster fishery** received high scores for all the categories except for the *Processing Workers*. As analyzed above, it is because of the high proportion of non-resident workers who have relatively lower wages and lower social standings.

The **Indonesia BSC fishery** received relatively high scores in the *Processing and Support Industry and Market*, marginally acceptable scores in the *Boat Owners/Captains, Fishing Crews, Processing Owners/Managers, Processing Workers, and Risk Exposure*. The *Harvest Sector Asset Performance* and *Post-Harvest Asset Performance* have room for substantial improvement. The scores for *Harvest Performance and Fish Stock Health and Environmental Performance* are within the warning zone, suggesting an urgent need to improve fish stock health and harvest performance. In the long run, sustainability of the fishery is at risk, and high scores for other categories will be undermined.

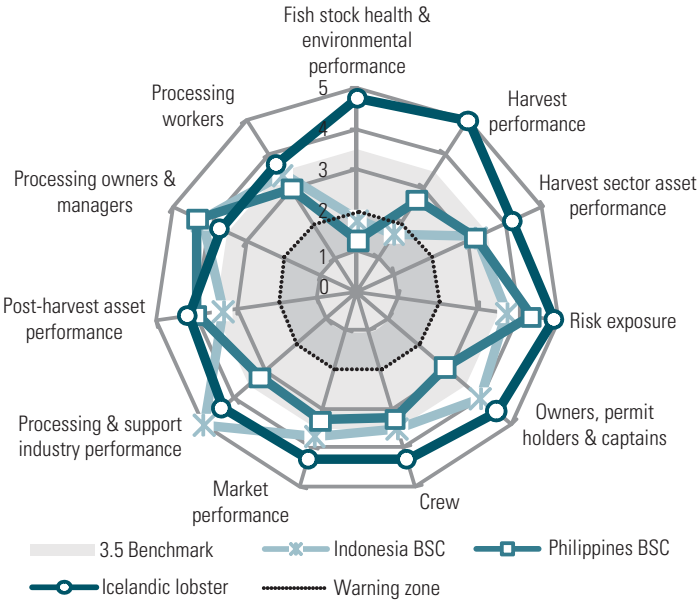
The **Philippines BSC fishery** showed relative better risk exposure, satisfactory performance for *Processing Owners/Managers* and *Post-Harvest Assets*. The *Market Performance, Crew and Boat Owners/Captains* have an opportunity to improve. All the rest have substantial room for improvement, including the *Harvest Sector, Boat Owners/Captains, Processing and Support Industry and Processing Work*ers. The *Fish Stock and Environmental Performance* received the lowest score and is in urgent need of attention to reverse the situation.

Figure 5.2 summarizes the average indictor scores for the wealth input factors. **Icelandic lobster fishery** received high scores for most of the categories, including environmental performance, good governance, good infrastructure, well-established data collection system, and considerable fishery management inputs (expenditures and personnel). However, the participation of the fishing industry in fishery management is low and market institution is around the edge.

The **Indonesia BSC fishery** does not face exceptional risk from exogenous environmental shocks. The infrastructure and market institution are marginally acceptable. However, the majority of the input factors may create significant constraints to enabling economic, ecological, and community sustainability. The macro factors, such as country-level governance, the economic conditions, and environmental performance scored poorly and may undermine the long-term success of the BSC industry. Access rights and harvest rights, such as individual or community quotas or catch shares, are not formally defined. The data collection system is not set up. All these contribute to limiting the accomplishment of the triple bottom line.

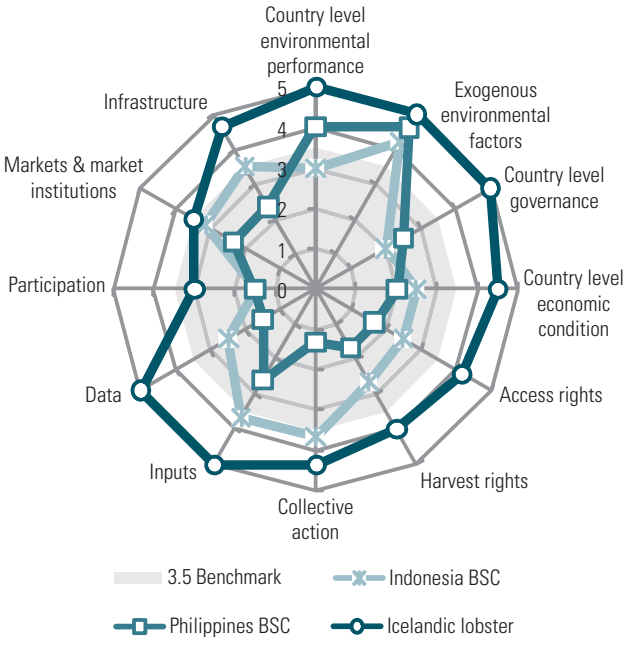
The **Philippines BSC fishery** has relatively acceptable environmental performance and exogenous environmental shock is not an inordinate risk. Most of the other enabling factor scores suggest weak governance and economic conditions, and under investment in access rights and harvest rights, data collection and analysis, the market institutions, and the basic infrastructure.

FIGURE 5.1: Summary of FPIs' Output—Measuring Wealth



Source: Authors.

FIGURE 5.2: Summary of FPIs' Input—Enabling Wealth



Source: Authors.

5.2 REGARDING THE FISHERY PERFORMANCE INDICATORS (FPIs)

The application of the FPIs to the Indonesia and Philippine BSC fisheries and the Icelandic lobster fisheries was remarkably successful. Furthermore, the feedback from the research workshop in May 2011 and the decision meeting in November 2011 were very positive and encouraging. FPIs are well organized and easy to apply. The rapid assessment result can give a clear indicator about the ecological, social, and economic status of the fisheries management systems. FPIs are useful and powerful tools for fishery project monitoring and evaluation. Because the cost of applying this is relatively low, only a few local experts who know the fishery well and who understand some basic economics and statistics are needed to fill out the FPIs survey form.

Based on the case study and comments received from the decision meeting, a few indicators need to be modified,

several scalings of the indicators need to be improved, and some omissions need to be added, particularly on the ecological output indicators and management and comanagement input indicators. These have been revised[6] and the FPIs are ready to be scaled up.

FPIs could serve as a tool to benchmark and monitor all the fishery projects in the World Bank. A detailed FPI assessment for each targeted country will assist management decisions for all the target fishery projects regardless of their implementation status. For projects that are in the planning stage, the output will help identify the strengths and weaknesses of the fisheries and thus enable the identification of evidence-based policy suggestions. For projects under implementation, the output will help measure their effectiveness in improving fishery performance.

The Bank is moving to enhance its activity related to the oceans, and the FPIs will have great value in identifying key target fisheries and measuring progress. At maturity, the FPIs could be implemented and accessed via a dashboard containing hundreds of fisheries, with data collected at regular intervals to monitor sustainable wealth-creating fisheries within and across management systems. The idea, logic, and design of the indicators can help develop a broadened set that can be applied to codependent fishery-aquaculture and aquaculture management systems.

Above all, the impact of these indicators is potentially transformative. They will be effective levers to promote changes and suggest what changes should be made to result in sustainable improvement in the fishery, the economic conditions, and community status.

6 After the decision meeting, all of the above suggestions have been integrated into the FPIs' survey sheets. A few case studies have been done since November 2011, including Uganda Nile perch and tilapia fisheries, Gambia sole fishery, Seychelles artisanal and semi-industrial fisheries, and Ghana artisanal fisheries.

Appendix A: FISHERY PERFORMANCE INDICATORS—MANUAL

FISHERY PERFORMANCE INDICATORS—OUTPUT

A.1. ECOLOGICALLY SUSTAINABLE FISHERIES

A.1.1 Fish Stock Health and Environmental Performance

A.1.1.1 Proportion of Harvest with a Third-Party Certification

Rationale: Fish stocks must be sustainable to generate sustainable returns and create wealth. Certification also may be essential for market access in developed countries.

Proposed Measure: The proportion of harvest (quantity) harvested under one of the recognized third-party programs that certify ecological sustainability, such as the Marine Stewardship Council (MSC) certification. Individual stocks are weighted by their proportion of landings value: 5: 76 to 100 percent of landings are certified; 4: 51 to 75 percent; 3: 26 to 50 percent; 2: 1 to 25 percent; 1: No landings have third-party certification.

A.1.1.2 Fish Stock Sustainability Index

Rationale: Fish stocks must be sustainable to generate sustainable returns and create wealth.

Proposed Measure: The Fish Stock Sustainability Index. The FSSI is calculated by assigning a total score between 0 and 4 to each priority fish stock. Note: The number of priority stocks will differ between management systems (The Fish Stock Sustainability Index 2009).

For each of four components, each stock receives: 1) one point if the status of the stock is overfished or subject to overfishing; 2) two points if management measures are succeeding at preventing overfishing; 3) three points if the stock biomass is above the level defined as overfished for the stock; and 4) four points if the stock is rebuilt or is at its "optimal" level, within 80 percent of that required to achieve maximum sustainable yield. The FSSI is computed by summing the scores of the individual stocks. Points by quintile relative to the maximum possible score; with 5 points for highest quintile.

A.1.1.3 Percentage of Stocks Overfished

Rationale: The percentage of stocks considered to be overfished reflects the extent to which overfishing has compromised the ability to generate wealth. Overfished stocks cannot be harvested at a level that maximizes wealth until they are recovered.

Proposed Measure: Percentage of commercial stocks within the management authority's purview that are considered overfished, to be experiencing overfishing, or in generally unknown stock status (whether actively managed or not): 5: None overfished; 4:1~25 percent of stocks overfished; 3:26 to 50 percent overfished; 2: 51 to 75 percent overfished; 1: 76 to 100 percent overfished.

A.1.1.4 Nonlandings Mortality

Rationale: Nonlandings mortality is a direct measure of waste and potentially foregone wealth. This represents fish that possibly could have been sold, but were not.

Proposed Measure: Ratio of estimated mortality of the assessed target species from illegal harvest, by-catch, illegal discards, regulatory (legal) discards, and other nonlandings waste to actual landings.

Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: Virtually none; 4: Less than 5 percent; 3: 5 to 10 percent; 2: 10 to 20 percent; 1: More than 20 percent.

A.2. HARVEST SECTOR PERFORMANCE

A.2.1 Harvest Performance

A.2.1.1 Landings Level

Rationale: Harvests at the level of maximum economic yield (MEY) reflect management and/or harvest policies that reflect economic goals. This is primarily a measure of the extent to which the fishery is realizing its potential wealth over time, ensuring the future reproductive value remains in the water.

Proposed Measure: Average annual harvest over the last 3 years. Note: in practice there are very few estimates of MEY, however where it has been calculated it is typically 5 to 10 percent less than maximum sustainable yield (MSY). Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: Harvest is less than MSY (stock is above MSY level) to increase profit; 4: Harvest is approximately at MSY; 3: Harvest reduced to promote recovery (stock is below MEY level); 2: Harvest is constraining stock recovery (stock is stable below MEY level); 1: Harvest is causing overfishing (stock is below MEY and declining).

A.2.1.2 Excess Capacity

Rationale: Excess capacity in the fishing fleet reflects management that has either allowed the stock to decline so that a once-efficient harvesting operation scale is now too large, or that has induced a derby wherein harvesters have had to purchase inefficiently large vessels, or both. These inefficiently large vessels are more expensive to operate and maintain than necessary, reducing wealth in the harvesting sector.

Proposed Measure: Estimated standardized vessels-days required to catch the maximum economic yield (MEY) compared to the number of standardized vessel-days available. Days are considered not to be restricted by trip limits. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: Within 5 percent of days required; 4: 105 to 120 or 90 to 95 percent; 3: 120 to 150 percent or 75 to 90 percent; 2: 150 to 200 percent or 50 to 75 percent; 1: More than 200 percent, or less than 50 percent, of days required.

A.2.1.3 Season Length

Rationale: The length of the season reflects the extent to which management allows harvesters to determine when to harvest and how much. Choosing how and when to harvest allows harvesters to land when the prices are highest, or to spread the harvest over a long period of time to stabilize ex-vessel prices at high levels, and allow processors to time product flow to implement efficient methods.

Proposed Measure: Ratio of number of days on which fishing occurs to the number of days the species is available in economically feasible quantities: 5: Virtually no regulatory closures; 4: 91 to 99 percent; 3: 50 to 90 percent; 2: 11 to 50 percent; 1: Less than 10 percent.

A.2.1.4 Ratio of Asset Value to Gross Earnings

Rationale: In addition to income, fishery wealth can also accumulate to the harvesters through the value of the assets that allow access and participation in the fishery. The price of the privilege or right to access a fishery in the form of a vessel, license, lease, or quota, is a direct measure of the accumulation of wealth from the fishery to the harvest sector. The price of access should reflect the present discounted value of the stream of profits arising from accessing the fishery. This will include expectations for changes in management, harvest levels, prices, and harvesting costs. Gross earnings is used to normalize the asset value to the levels of the fishery. Gross earnings are a proxy for net earnings because cost data are rarely available, and this normalization is standard in agricultural frameworks. For a fixed level of gross earnings, if the fishery's income is highly uncertain, or costs are excessive, then the ratio will be lower.

Proposed Measure: Ratio of average price of access to the fishery over the last 5 years to the average annual landings value for a similarly scaled access right in the same period. Same business or same family sales are excluded, where they can be identified. The highest bin boundary was established by calculating the rate of return for large-scale farming operations in the United States, reflecting a stable industry where key inputs are controlled by the business owner: 5: 10 or higher; 4: 7.5 to 10; 3: 5 to 7.5; 2: 2.5 to 5; 1: 2.5 or below.

A.2.2 Asset Performance

A.2.2.1 Total Revenue versus Historic High

Rationale: If the fishery is generating wealth, it is expected that the total revenue for the fishery is likely to increase to some sustainable maximum range. Fisheries with declining total revenue are likely to be in decline as a result of overfishing, poor marketing, and distribution. In contrast, a fishery managed for wealth creation should be harvested sustainably, and the sector is likely to orient toward market access and innovation. This should be observable in stable or increasing total revenue.

Proposed Measure: The indicator is the ratio of total revenue to the average of the three highest total revenues in the past 10 years. 5: Above 95 percent; 4: 85 to 95 percent; 3: 70 to 85 percent; 2: 50 to 70 percent; 1: Below 50 percent.

A.2.2.2 Asset (Permit, Quota, etc.) Value versus Historic High

Rationale: If the fishery is generating wealth, it is expected that the value of the permit, quota, or other right to the fishery is likely to increase to some sustainable maximum range.

Fisheries with declining assets are likely to be in decline as a result of overfishing, poor marketing, distribution, or other constraints to innovation. In contrast, a fishery managed for wealth creation should be harvested sustainably; the sector is likely to orient toward improved marketing and innovation.

Proposed Measure: The indicator is the ratio of asset to the average of the three highest asset values in the past 10 years. 5: Above 95 percent; 4: 85 to 95 percent; 3: 70 to 85 percent; 2: 50 to 70 percent; 1: Below 50 percent.

A.2.2.3 Borrowing Rate Relative to Risk-Free Rate

Rationale: The size of the premium the capital market demands to make loans in the fishery is a direct measure of financial risk in the industry. It is locally normalized to reflect the overall riskiness in the region and the opportunities available to local capital.

Proposed Measure: Average ratio between the interest rate on loans made in the industry to risk-free rates over the last 3 years. Bin boundaries are based on the ratio of consumer loan rates for different types of rates to the regional 10-year risk-free rate (3.60 percent for U.S. T-bill; example ratios below): 5: Less than 1.75; cf. 30-year conforming mortgage; 4: Less than 2.5; cf. personal bank loan; 3: Less than 4; cf. good credit card rates; 2: Less than 7; cf. bad credit card rates; 1: Greater than 7; usury.

A.2.2.4 Source of Capital

Rationale: Whether lending capital from a particular source is even available is a direct measure of how the capital market assesses risk in the fishery. If a certain type of lender or investor is not willing to make capital available in the fishery at any price, it reveals the fishery is much riskier than other available investments. This measure is less refined than the relative rate, but much easier to obtain.

Proposed Measure: Points to be assigned based on the category of lenders or investors that is most typically used in the fishery. Points assigned as follows: 5: Unsecured business loans from banks/venture capital; 4: Secured business loans from banks/public stock offering; 3: Loans from banks secured by personal (not business) assets/government-subsidized private lending/government-run loan programs/international aid agencies; 2: Microlending/family/community-based lending; 1: Mafia/no capital available.

A.2.2.5 Functionality of Harvest Capital

Rationale: The functionality of the vessels and other capital used in harvesting (e.g., weirs, traps, docks/marinas, and ice production) reflects wealth in several ways. First, it is a direct measure of wealth that has been accumulated from the fishery and reinvested in capital. Second, it is a measure of the potential wealth in the fishery, as newer facilities will be more efficient and less costly to operate. Third, if harvesters are willing to invest in new capital, it reflects their assessment that the fishery will be profitable into the future. Finally, if new facilities are funded by private loans, newer facilities reflect the capital markets' assessment that the fishery is sufficiently low risk to warrant investment.

Proposed Measure: Average age of the key durable harvesting capital unit (vessels, weirs): 5: Capital is new; 4: Capital is older but well maintained, e.g., freshly painted; 3: Capital is moderately well maintained; 2: Maintenance is poor; 1: Serious concerns about seaworthiness or safety throughout fishery.

A.2.3 Risk

A.2.3.1 Annual Total Revenue Volatility

Rationale: Annual total revenue volatility is primarily a measure of the riskiness of the fishery. When future harvests are variable, it is difficult to make investment decisions and secure capital because future income streams are highly uncertain. High landings volatility also presents an obstacle to developing final product markets in nonspecialty fisheries, as large processors and exporters prefer to deal with products for which they can develop long-term contracts.

Proposed Measure: Ratio of the standard deviation of the first differences of annual total revenue to the mean total revenue over the last 10 years. Bin boundaries should be established by quintile once data are collected on many fisheries. Pilot study boundaries were established by calculating the score for each country-fish category (finfish, shellfish, and crustaceans only) in FishStat (FAO), then determining the quintile values[7]: 5: 0.14 or less; 4: 0.15 to 0.21; 3: 0.22 to 0.39; 2: 0.40 to 0.99; 1: 1 or greater.

A.2.3.2 Annual Landings Volatility

Rationale: Annual landings volatility is primarily a measure of the riskiness of the fishery. When future harvests are variable, it is difficult to make investment decisions and secure capital because future income streams are highly uncertain. High landings volatility also presents an obstacle to developing final product markets in nonspecialty fisheries, as large processors and exporters prefer to deal with products for which they can develop long-term contracts.

7 This approach uses more highly aggregated fisheries than are likely to be used in case studies. This probably results in lower variance, and thus biases our bins toward lower scores.

Proposed Measure: Ratio of the standard deviation of the first differences of annual total landings sold to the mean landings over the last 10 years. Bin boundaries should be established by quintile once data are collected on many fisheries. Pilot study boundaries were established by calculating the score for each country-fish category (finfish, shellfish and crustaceans only) in FishStat (FAO), then determining the quintile values[8]: 5: 0.14 or less; 4: 0.15 to 0.21; 3: 0.22 to 0.39; 2: 0.40 to 0.99; 1: 1 or greater.

A.2.3.3 Intra-Annual Landings Volatility

Rationale: High-frequency (weekly or monthly, as available) landings volatility is primarily a measure of the potential for wealth generation in the fishery. High volatility may reflect a seasonality of the availability of the fish for harvest, or management that limits the harvest season directly, or induces a derby. Spikes in landings during certain parts of the year hinder wealth creation in several ways. First, concentrating landings in a short period spikes supply and often suppresses ex-vessel prices. Second, processing capacity must be established to handle the spikes, and if it is not applied to other fisheries, it will be underutilized and costly per unit processed. Third, spikes in processing volume often compromise the yield and quality of the processed product. Finally, intra-annual volatility can make it difficult for processors to make forward contracts for their products; thus they receive lower prices.

Proposed Measure: Ratio of the standard deviation of the weekly/monthly total sold landings over the last 3 years to the mean landings. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is not meaningful variation at a monthly level, this measure can be NA.[9] Bin boundaries should be established by quintile once data are collected on many fisheries. Absent monthly landings data on a range of fisheries, the pilot study uses the same bins as for Annual Landings Volatility: 5: 0.14 or less; 4: 0.15 to 0.21; 3: 0.22 to 0.39; 2: 0.40 to 0.99; 1: 1 or greater.

A.2.3.4 Annual Price Volatility

Rationale: Annual price volatility complements annual harvest volatility to capture the wealth generation potential in the fishery. When future revenues are variable, it is difficult to make investment decisions and secure capital because future income streams are highly uncertain. High price volatility may reflect obstacles to developing final product markets in nonspecialty fisheries, as large processors and exporters prefer to deal with products for which they can develop long-term contracts.

Proposed Measure: Ratio of the standard deviation of the first differences of annual ex-vessel price to the mean price over the last 10 years. Bin boundaries should be established by quintile once data are collected on many fisheries. Pilot study boundaries were established by calculating the score for each country-fish category (finfish, shellfish, and crustaceans only) in FishStat (FAO), then determining the quintile values[10]: 5: 0.12 or less; 4: 0.13 to 0.19; 3: 0.20 to 0.30; 2: 0.31 to 0.84; 1: 0.85 or greater.

A.2.3.5 Intra-Annual Price Volatility

Rationale: Intra-annual price volatility complements intra-annual harvest volatility to capture the wealth generation potential in the fishery. Price changes arise from: 1) shifts in demand stemming from seasonal changes in tastes (e.g., traditional holiday fish dishes) or 2) changes in supply stemming from the seasonal availability of fish or management-induced periods of high effort. If price volatility is high, unconstrained harvesters could shift landings from a period of low price to a period of higher price and increase fishery rent. Periods of high landings at low prices are associated with fishing derbies and the problems associated with high intra-annual landings volatility.

Proposed Measure: Ratio of the standard deviation of average monthly ex-vessel price over the last 3 years to the mean. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is not meaningful variation at a monthly level, this measure can be NA. Bin boundaries should be established by quintile once data are collected on many fisheries. Absent monthly price data on a range of fisheries, the pilot study uses the same bins as for Annual Price Volatility[11]: 5: 0.12 or less; 4: 0.13 to 0.19; 3: 0.20 to 0.30; 2: 0.31 to 0.84; 1: 0.85 or greater.

A.2.3.6 Spatial Price Volatility

Rationale: The extent to which ex-vessel price for the same product varies across different ports within the fishery reflects market integration and opportunities for arbitrage

8 This approach uses more highly aggregated fisheries than are likely to be used in case studies. This probably results in lower variance, and thus biases our bins toward lower scores.

9 More precisely prescribing the circumstances under which this should be NA will be determined in the case studies.

10 This approach uses more highly aggregated fisheries than are likely to be used in case studies. This probably results in lower variance, and thus biases our bins toward lower scores.

11 This approach uses more highly aggregated fisheries than are likely to be used in case studies. This probably results in lower variance, and thus biases our bins toward lower scores.

across space within the fishery. A market that is well integrated spatially will have similar prices at different ports, whereas isolated landings ports or ports that are differentially well connected to markets, and therefore posing greater financial risk, will have higher levels of spatial volatility.

Proposed Measure: Ratio of the standard deviation across data collection regions[12] of average annual ex-vessel price to the mean. Measure should be averaged over last 3 years. Bin boundaries should be established by quintile once data are collected on many fisheries. Absent spatial price data on a range of fisheries, the pilot study uses the same bins as for Annual Price Volatility[13]: 5: 0.12 or less; 4: 0.13 to 0.19; 3: 0.20 to 0.30; 2: 0.31 to 0.84; 1: 0.85 or greater.

A.2.3.7 Contestability and Legal Challenges

Rationale: Legal challenges, protests, and contentious public hearings reflect discontent with the management system. It is an indicator of a lack of social acceptance and a source of considerable risk.

Proposed Measure: 5: No significant legal challenges, civil actions, or protests regarding the fishery management system; 4: Minor legal challenges slow implementation; 3: Legal challenges, civil actions, or protests impede some management measures; 2: Legal challenges, civil actions, or protests suspend major elements of the management system; 1: Legal challenges, civil actions, or protests suspend or prohibit implementation of key management reforms and regulation.

A.2.4 Owners, Permit Holders, and Captains

A.2.4.1 Earnings Compared to National Average Earnings

Rationale: This is a direct measure of fishery-produced wealth accumulating to owners of harvesting capital. Scaling earnings by national average earnings reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to national standards.

Proposed Measure: Ratio of annual earnings from fishing per owner to the national average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew. Bin boundaries can be established by percentile once a range of data is collected. For the pilot studies, the boundaries will be established by the following table: 5: More than 50 percent above the national average; 4: Between 10 and 50 percent above national average; 3: Within 10 percent of the national average; 2: Between 50 and 90 percent of the national average; 1: Less than half the national average.

A.2.4.2 Fishery Wages Compared to Nonfishery Wages

Rationale: This is a direct measure of fishery-produced wealth accumulating to harvesters. Scaling wages by average local earnings reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards. Here, the local standard is the local wage, rather than national income levels, which could pick up important rural/urban differences in heterogeneous countries.

Proposed Measure: Ratio of captain's average daily wage to average daily wage in region/country. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: More than 50 percent above the national average; 4: Between 10 and 50 percent above national average; 3: Within 10 percent of the national average; 2: Between 50 and 90 percent of the national average; 1: Less than half the national average.

A.2.4.3 Educational Access

Rationale: A community that is successfully using its resources will be able to provide high levels of education to its children, ensuring a step beyond resource dependence in the next generation. If capture fishing is an important part of this community, the boat owners or captains' families will have access to education.

Proposed Measure: Measure is based on the highest level of education that is politically, culturally, and financially accessible to families of harvesters, rather than the actual attainment levels of current harvesters. 5: Higher education is accessible; 4: High school–level education or advanced technical training is accessible; 3: Middle school–level education or simple technical training is accessible; 2: Basic literacy and arithmetic education is accessible; 1: Formal education is not accessible.

A.2.4.4 Health Care Access

Rationale: A community that is successfully using its resources will be able to provide high levels of health care, ensuring a quality of life and decreasing health risk. If capture fishing is an important part of this community, harvester's families will have access to the best available health care.

12 Data collection regions can either be fishery relevant or politically relevant. Defining this generally allows local standards to establish which is most important.

13 This approach uses more highly aggregated fisheries than are likely to be used in case studies. This probably results in lower variance, and thus biases our bins toward lower scores.

Proposed Measure: Measure is based on the quality of health care that is politically, culturally, and financially accessible to harvesters. 5: Global standard treatment for trauma and illness is accessible; 4: Licensed doctors provide trauma, surgical, and drug treatments; 3: Nurses or medical practitioners provide emergency and routine drug treatments; 2: First aid and basic drug (e.g., penicillin) treatment is accessible; 1: Science-based health care is not accessible.

A.2.4.5 Social Standing of Boat Owners and Permit Holders

Rationale: This is a proxy for income associated with boat and permit ownership, which may be much easier to collect than actual income information. It also allows informal incorporation of part-time harvesting jobs into other careers. Social standing reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards.

Proposed Measure: 5: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers; 4: Comparable to management and white-collar jobs; 3: Comparable to skilled labor jobs; 2: Comparable to unskilled blue-collar or service jobs; 1: Among the least respected, such as slaves or indentured servants.

A.2.4.6 Proportion of Nonresident Employment

Rationale: The ability of a country or region to improve itself using its resources depends on its ability to maintain local multipliers by keeping wealth within the region. A large portion of nonresident harvesters reflects that much of the harvesting wealth will be leaving the region, failing to boost the regional economy. In developing regions, it may also reflect an inability of local resource users to generate sufficient capital to harvest.

Proposed Measure: 5: 95 to 100 percent local; 4: 71 to 95 percent local; 3: 36 to 70 percent local; 2: 5 to 35 percent local; 1: Virtually no local harvesters.

A.2.5 Crew

A.2.5.1 Earnings Compared to National Average Earnings

Rationale: This is a direct measure of fishery-produced wealth accumulating to crew. Scaling earnings by average national earnings reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards.

Proposed Measure: Ratio of annual earnings from fishing per owner to the national average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew. Bin boundaries can be established by percentile once a range of data are collected. For the pilot studies, the boundaries will be established by the following table: 5: More than 10 percent above the average; 4: Within 10 percent of the average; 3: Between 60 and 90 percent of the average; 2: Between 25 and 50 percent of the average; 1: Less than 25 percent of the average.

A.2.5.2 Fishery Wages Compared to Nonfishery Wages

Rationale: Crew wage is a direct measure of the fishery wealth that accumulates to crew. It is normalized by wages typical of the region to provide a relative standard of living afforded to crew, and also reflect whether the fishery is able to attract the most skilled workers.

Proposed Measure: Ratio of crew's average daily wage to average daily wage in region/country. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: More than 10 percent above the average; 4: Within 10 percent of the average; 3: Between 60 and 90 percent of the average; 2: Between 25 and 50 percent of the average; 1: Less than 25 percent of the average.

A.2.5.3 Educational Access

Rationale: A community that is successfully using its resources will be able to provide high levels of education to its children, ensuring a step beyond resource dependence in the next generation. If capture fishing is an important part of this community, harvesters' families will have access to education.

Proposed Measure: Measure is based on the highest level of education that is politically, culturally, and financially accessible to families of harvesters, rather than the actual attainment levels of current harvesters. 5: Higher education is accessible; 4: High school–level education or advanced technical training is accessible; 3: Middle school–level education or simple technical training is accessible; 2: Basic literacy and arithmetic education is accessible; 1: Formal education is not accessible.

A.2.5.4 Health Care Access

Rationale: A community that is successfully using its resources will be able to provide high levels of health care, ensuring a quality of life and decreasing health risk. If capture fishing is an important part of this community, harvesters' families will have access to the best available health care.

Proposed Measure: Measure is based on the quality of health care that is politically, culturally, and financially accessible to

harvesters. 5: Global standard treatment for trauma and illness is accessible; 4: Licensed doctors provide trauma, surgical, and drug treatments; 3: Nurses or medical practitioners provide emergency and routine drug treatments; 2: First aid and basic drug (e.g., penicillin) treatment is accessible; 1: Science-based health care is not accessible.

A.2.5.5 Social Standing of Crew

Rationale: This is a proxy for income associated with crewing on fishing boats, which may be much easier to collect than actual wage information. It also allows informal incorporation of part-time harvesting jobs into other careers. Social standing reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards.

Proposed Measure: 5: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers; 4: Comparable to management and white-collar jobs; 3: Comparable to skilled labor jobs; 2: Comparable to unskilled blue-collar or service jobs; 1: Among the least respected, such as slaves or indentured servants.

A.2.5.6 Proportion of Nonresident Employment

Rationale: The ability of a country or region to improve itself using its resources depends on its ability to maintain local multipliers by keeping wealth within the region. A large portion of nonresident harvesters reflects that much of the harvesting wealth will be leaving the region, failing to boost the regional economy. In developing regions, it may also reflect an inability of local resource users to generate sufficient capital to harvest.

Proposed Measure: 5: 95 to 100 percent local; 4: 71 to 95 percent local; 3: 36 to 70 percent local; 2: 5 to 35 percent local; 1: Virtually no local crew.

A.2.5.7 Crew Experience

Rationale: The rate at which the crew force turns over in the fishery is an indirect measure of several key variables. First, it reflects wealth accumulation to crew because a crew member will only stay in the fishery if the wage is comparable to, or better than, other jobs he could obtain. Second, crew longevity often means they are resident in the community, and thus their earnings stay in the community and are spent locally, rather than being sent away by itinerant or immigrant crews. Third, experienced crew develop specialized knowledge and refined skills that make harvesting more efficient, so the fishery is better able to reach its wealth-generating potential. Finally, many crew will stay in the fishery if they believe the future to be worthwhile and that they will have the means to succeed to captain.

Proposed Measure: Average years of experience of crew members. Bin boundaries can be established by quintile once data is collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: More than 20 years (skilled career crew); 4: 5 to 20 years; 3: 3 to 5 years; 2: 1 to 3 years; 1: 0 full years of experience (mostly new crew each season).

A.2.5.8 Age Structure of Harvesters

Rationale: A widely distributed age structure is an indirect measure of several key variables. Broadly, it reflects both that experienced older crew is willing to stay in the fishery, possibly as captains, and that younger crew members are willing to enter and that job opportunities in the fishery are available. First, it reflects wealth accumulation to crew because an experienced crew member will only stay in the fishery, and a new crew member will only enter, if the wage is comparable to, or better than, other jobs he could obtain. Second, crew longevity often means the crew are resident in the community, and thus their earnings stay in the community and are spent locally, rather than being sent away by itinerant or immigrant crews. Third, experienced crew develop specialized knowledge and refined skills that make harvesting more efficient, so the fishery is better able to reach its wealth-generating potential. Finally, many crew will only enter (young) or stay in (older) the fishery if they believe the future to be worthwhile and that they will have the means to succeed to captain.

Proposed Measure: Age range of both captains and their crews: 5: All working ages are well represented; 4: Slightly skewed toward younger or older; 3: Skewed toward younger or older; 2: Almost entirely younger or older, but working age; 1: Harvesters primarily younger or older than working age.

A.3. POST-HARVEST PERFORMANCE

A.3.1 Market Performance

A.3.1.1 Ex-Vessel Price versus Historic High

Rationale: If the fishery is generating wealth, it is expected that the orientation of the fishery will shift from competing for fishery resource access, to market access and development. This should be observable in stable or increasing ex-vessel prices.

Proposed Measure: The indicator is the ratio of annual ex-vessel prices to the average of the three highest annual ex-vessel prices in the past 10 years. 5: Above 95 percent; 4:

85 to 95 percent; 3: 70 to 85 percent; 2: 50 to 70 percent; 1: Below 50 percent.

A.3.1.2 Final Market Use

Rationale: The use of the fishery product that is finally consumed reflects the extent to which the fishery, its processing, and trade products are maximizing the potential value from the resource.

Proposed Measure: 5: Premium human consumption (premium quality and products); 4: High-value human consumption; 3: Moderate-value human consumption; 2: Low-value human consumption; 1: Fish meal/animal feed/bait or nonconsumptive.

A.3.1.3 International Trade

Rationale: Maximizing the wealth generation potential of a fishery requires delivering the product to the people who value it most. The level of exports reflects how well the fishery has maximized its wealth potential by accessing the market that is willing to pay the most for the product globally.

Proposed Measure: Percentage of the fishery's value that is from fish exported for consumption: 5: 90 to 100 percent export; 4: 61 to 90 percent export; 3: 31 to 60 percent export; 2: 2 to 30 percent export; 1: Virtually no export.

A.3.1.4 Final Market Wealth

Rationale: The income of the people who finally consume the fishery product reflects the extent to which the fishery, its processing, and trade products are maximizing the potential value from the resource. Products that are being sold in wealthier countries are competing favorably, reflecting high-quality, effective marketing, and are drawing wealth to the fishery.

Proposed Measure: Average per capita GDP of the consumer of a fishery's final product (pounds weighted by GDP).

(U.S. CIA's rank of per capita GDP of all countries https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html): 5: Greater than US$35,000; 4: Greater than US$25,000; 3: Greater than US$12,500; 2: Greater than US$5,000; 1: Less than US$5,000.

A.3.1.5 Wholesale Price Relative to Similar Products

Rationale: The extent to which a country's fishing industry is realizing its wealth generation potential is captured by comparing the price that country receives with the price for substantially similar products in other countries.

Proposed Measure: Ratio of average price for fish weight in wholesale (primary) fish product from the base country, to a global average for similar species: 5: More than twice global average; 4: 120 to 200 percent global average; 3: Within 20 percent of global average; 2: 50 to 80 percent of global average; 1: Less than half global average.

A.3.1.6 Capacity of Firms to Export to the United States and European Union

Rationale: Companies with unreliable, low-quality, or unsecure supply chains may not be able to export to the United States or European Union without detention. The more freely a company can export to the United States or European Union, the broader the market. Access reflects the success of quality control systems and breadth of market. It is also a measure of the financial risk associated with international trade.

Proposed Measure: Percentage of a country's fish exports that are approved for export to the United States or European Union: 5: 95 to 100 percent approved; 4: 71 to 95 percent; 3: 36 to 70 percent; 2: 5 to 35 percent; 1: Virtually none approved.

A.3.1.7 Ex-Vessel to Wholesale Marketing Margins

Rationale: The value added by processing and marketing at the wholesale level is a direct measure of wealth accumulation in the processing sector. When compared across products, it can also represent how well a fishery is realizing the maximum potential value from its landed fish.

Proposed Measure: Ratio of ex-vessel price to wholesale price (adjusted for standard meat yield rates). To make the adjustment, divide the ex-vessel price by a standard processing yield, and divide by the wholesale price. Bin boundaries can be established by quintile once there is data on a range of fisheries. For the pilot studies, the following table can be used: 5: Less than 0.3; 4: 0.3 to 0.5; 3: 0.5 to 0.8; 2: 0.8 to 0.95; 1: 0.95 or more.

A.3.2 Processing and Support Industry Performance

A.3.2.1 Yield of Processed Product

Rationale: Processing yield is a measure of the potential value of the landed fish that is being realized as wealth. Yield will likely be higher in more efficient processing operations and those with a steady supply of landed product where there is time to take more care in processing and develop downline customers who will pay a premium for reliable forward contracts for premium products. They may also be able to turn processing by-products (bones, blood) into revenue streams, increasing value per landed weight.

Proposed Measure: Ratio of actual yield (pounds) to the maximum yield technically achievable. Bin boundaries can be

established by quintile once there is data on a range of fisheries. For the pilot studies, the following table can be used: 5: At feasible frontier; 4: Within 5 percent of the feasible frontier; 3: Within 10 percent; 2: Within 25 percent; 1: Less than 75 percent of maximum yield.

A.3.2.2 Capacity Utilization Rate

Rationale: In many fisheries, a hindrance to wealth accumulation is an excess of capital, even in processing. This may occur because the fishery was once larger than it is now and it is difficult to downsize plants, or because management or biology forces landings to be concentrated in a short period of time. Potential wealth is then consumed in maintaining a larger than necessary facility, or in tying up capital in a facility that is not used to full capacity. In fisheries where landings and processing are concentrated within a short season, this inefficiency may be compounded by using processing technology at a rate that does not support high yields when landings are occurring.

Proposed Measure: Days open for processing each year. Such days would not normally include religious or civic holidays, or weekly rest days. Bin boundaries can be established by quintile once there is data on a range of fisheries. For the pilot studies, the following table can be used: 5: Virtually year-round; 4: 75 to 95 percent of days; 3: 51 to 75 percent; 2: 21 to 50 percent; 1: Less than 20 percent.

A.3.2.3 Product Improvement

Rationale: One way processors can maximize the value of a product is to market it with improvements that make it more appealing to the consumer, who will then pay more for the product. Sale with a certification, value-enhancing branding, or value-added processing can increase wholesale and retail prices, and thus the wealth brought to the fishery.

Proposed Measure: Proportion of harvest meat weight going into certified, branded, or value-added products: 5: 76 to 100 percent of landings are enhanced; 4: 51 to 75 percent; 3: 26 to 50 percent; 2: 1 to 25 percent; 1: No landings have enhancements.

A.3.2.4 Regional Support Businesses

Rationale: The strength of the marine support sector is important to realizing the maximum potential wealth through efficient harvesting. Sales in the support sector are a direct measure of wealth accumulation in the support sector. However, they also reflect the ability of the fishery to access and adopt new technology to make harvesting more efficient and profitable, and the propensity for the fishery to do so, as sales to harvesters support these businesses.

Proposed Measure: 5: All types of support are plentiful; 4: Some types of support are capacity constrained or unavailable; 3: Most types of support are capacity constrained or unavailable; 2: Support limited to variable inputs; 1: Industry support is not locally available.

A.3.2.5 Time to Repair

Rationale: The amount of time required to make a major repair, including especially that to acquire parts, reflects how well the fishery is connected to the infrastructure necessary to maintain capital. Because this connectedness arises when there is a market for capital maintenance services, this captures how well the fishery is adopting new, efficient technologies that maximize wealth generation. It is also a measure of riskiness of capital investment, as the ability to effectively maintain new capital is critical to extracting and preserving its value.

Proposed Measure: Days required to make a major mechanical repair to a vessel (e.g., blown valve) that requires a replacement part, including wait time: 5: Less than a week; 4: One week to one month; 3: One month to less than a season; 2: Full season; 1: Major repair not possible.

A.3.3 Post-Harvest Asset Performance

A.3.3.1 Borrowing Rate Relative to Risk-Free Rate

Rationale: The size of the premium the capital market demands to make loans in the processing sector is a direct measure of financial risk in the industry. It is locally normalized to reflect the overall riskiness in the region and the opportunities available to local capital.

Proposed Measure: Average ratio between the interest rate on loans made in the industry to risk-free rates over the last 3 years. Bin boundaries are based on the ratio of consumer loan rates for different types of rates to the regional 10-year risk-free rate (3.60 percent for U.S. T-bill; example ratios below): 5: Less than 1.75; cf. 30-year conforming mortgage; 4: Less than 2.5; cf. personal bank loan; 3: Less than 4; cf. good credit card rates; 2: Less than 7; cf. bad credit card rates; 1: Greater than 7; usury.

A.3.3.2 Source of Capital

Rationale: Whether lending capital from a particular source is even available is a direct measure of how the capital market assesses risk in the fishery's processing sector. If a certain type of lender or investor is not willing to make capital available in the processing sector at any price, it reveals that it is much riskier than other available investments. This measure is less refined than the relative rate but is much easier to obtain.

Proposed Measure: Points to be assigned based on category of lenders or investors that is most typically used in the processing sector. Points assigned as follows: 5: Unsecured business loans from banks/venture capital; 4: Secured business loans from banks/public stock offering; 3: Loans from banks secured by personal (not business) assets/government-subsidized private lending/government-run loan programs/international aid agencies; 2: Microlending/family/community-based lending; 1: Mafia/no capital available.

A.3.3.3 Age of Facilities

Rationale: The age of the facilities used in processing harvests, primarily processing plants and storage facilities, reflects several dimensions of fishery wealth. First, it is a direct measure of wealth that has been accumulated from the fishery and reinvested in capital. Second, it is a measure of the potential wealth in the fishery, as newer facilities will be more efficient and less costly to operate. Third, if processors are willing to invest in new capital, it reflects their assessment that the fishery will be profitable into the future. Finally, if new facilities are funded by private loans, newer facilities reflect the capital market's assessment that the fishery is sufficiently low risk to warrant investment.

Proposed Measure: Average age of the key durable processing capital unit (plants, catcher-processor vessels): 5: Less than 7 years; first quarter of expected life; 4: 7 to 15 years; second quarter of expected life; 3: 15 to 20 years; third quarter of expected life; 2: 20 to 25 years; fourth quarter of expected life; 1: Greater than 25 years; exceeding expected life.

A.3.4 Processing Owners and Managers

A.3.4.1 Earnings Compared to National Average Earnings

Rationale: This is a direct measure of fishery-produced wealth accumulating to processing owners and managers. Scaling earnings by average national earnings reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards.

Proposed Measure: Ratio of annual earnings from processing per owner to the national average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew. Bin boundaries can be established by percentile once a range of data are collected. For the pilot studies, the boundaries will be established by the following table: 5: More than 50 percent above the national average; 4: Between 10 and 50 percent above national average; 3: Within 10 percent of the national average; 2: Between 50 and 90 percent of the national average; 1: Less than half the national average.

A.3.4.2 Manager Wages Compared to Nonfishery Wages

Rationale: The processing owner or manager wage is a direct measure of fishery wealth that accumulates to processing workers. It is normalized by wages typical of the region to provide an indicator of the relative standard of living afforded to managers, and also reflect whether the industry is able to attract the most skilled managers.

Proposed Measure: Ratio of managers' average daily wage to average daily wage in region. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: More than 50 percent above the national average; 4: Between 10 and 50 percent above national average; 3: Within 10 percent of the national average; 2: Between 50 and 90 percent of the national average; 1: Less than half the national average.

A.3.4.3 Educational Access

Rationale: A community that is successfully using its resources will be able to provide high levels of education to its children, ensuring a step beyond resource dependence in the next generation. If processing is an important part of this community, processing owners' families will have access to education.

Proposed Measure: Measure is based on the highest level of education that is politically, culturally, and financially accessible to families of harvesters, rather than the actual attainment levels of current harvesters. 5: Higher education is accessible; 4: High school–level education or advanced technical training is accessible; 3: Middle school–level education or simple technical training is accessible; 2: Basic literacy and arithmetic education is accessible; 1: Formal education is not accessible.

A.3.4.4 Health Care Access

Rationale: A community that is successfully using its resources will be able to provide high levels of health care, ensuring a quality of life and decreasing health risk. If processing is an important part of this community, processing owners' families will have access to the best available health care.

Proposed Measure: Measure is based on the quality of health care that is politically, culturally, and financially accessible to harvesters: 5: Global standard treatment for trauma and illness is accessible; 4: Licensed doctors provide trauma, surgical, and drug treatments; 3: Nurses or medical practitioners provide emergency and routine drug treatments; 2: First aid and basic drug (e.g., penicillin) treatment is accessible; 1: Science-based health care is not accessible.

A.3.4.5 Social Standing of Processing Managers

Rationale: This is a proxy for income associated with owning or running processing plants, which may be much easier to collect than actual wage information. Social standing reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards.

Proposed Measure: 5: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers; 4: Comparable to management and white-collar jobs; 3: Comparable to skilled labor jobs; 2: Comparable to unskilled blue-collar or service jobs; 1: Among the least respected, such as slaves or indentured servants.

A.3.4.6 Nonresident Ownership of Processing Capacity

Rationale: The ability of a country or region to improve itself using its resources depends on its ability to maintain local multipliers by keeping wealth within the region. A large portion of nonresident-owned processing reflects that much of the processing wealth will be leaving the region, failing to boost the regional economy. In developing regions, it may also reflect an inability of local resource users to generate sufficient capital to process.

Proposed Measure: Proportion of ex-vessel value processed by regionally owned processing capital: 5: 95 to 100 percent local; 4: 71 to 95 percent local; 3: 36 to 70 percent local; 2: 5 to 35 percent local; 1: Virtually no locally owned processing.

A.3.5 Processing Workers

A.3.5.1 Earnings Compared to National Average Earnings

Rationale: This is a direct measure of fishery-produced wealth accumulating to processing workers. Scaling earnings by average national earnings reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards.

Proposed Measure: Ratio of annual earnings from fishing per owner to the national average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew. Bin boundaries can be established by percentile once a range of data is collected. For the pilot studies, the boundaries will be established by the following table: More than 10 percent above the average; Within 10 percent of the average; Between 50 and 90 percent of the average; Between 25 and 50 percent of the average; Less than 25 percent of the average.

A.3.5.2 Worker Wages Compared to Nonfishery Wages

Rationale: The processing worker wage is a direct measure of fishery wealth that accumulates to processing workers. It is normalized by wages typical of the region to provide an indicator of the relative standard of living afforded to workers, and also reflect whether the fishery is able to attract the most skilled workers.

Proposed Measure: Ratio of workers' average daily wage to average daily wage in region. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table:5: More than 10% above the average; 4 Within 10% of the average; 3 Between 50 and 90% of the average; 2 Between 25 and 50% of the average; 1 Less than 25% of the average.

A.3.5.3 Educational Access

Rationale: A community that is successfully using its resources will be able to provide high levels of education to its children, ensuring a step beyond resource dependence in the next generation. If processing is an important part of this community, processing workers' families will have access to education.

Proposed Measure: Measure is based on the highest level of education that is politically, culturally, and financially accessible to families of harvesters, rather than the actual attainment levels of current harvesters. 5: Higher education is accessible; 4: High school–level education or advanced technical training is accessible; 3: Middle school–level education or simple technical training is accessible; 2: Basic literacy and arithmetic education is accessible; 1: Formal education is not accessible.

A.3.5.4 Health Care Access

Rationale: A community that is successfully using its resources will be able to provide high levels of health care, ensuring a quality of life and decreasing health risk. If processing is an important part of this community, processing workers' families will have access to the best available health care.

Proposed Measure: Measure is based on the quality of health care that is politically, culturally, and financially accessible to harvesters: 5: Global standard treatment for trauma and illness is accessible; 4: Licensed doctors provide trauma, surgical and drug treatments; 3: Nurses or medical practitioners provide emergency and routine drug treatments; 2: First aid and basic drug (e.g., penicillin) treatment is accessible; 1: Science-based health care is not accessible.

A.3.5.5 Social Standing of Processing Workers

Rationale: This is a proxy for income associated with working in processing plants, which may be much easier to collect than actual wage information. Social standing reflects whether the fishery is able to attract the most talented workers in the community and is doing well at wealth generation relative to local standards. 5: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers; 4: Comparable to management and white-collar jobs; 3: Comparable to skilled labor jobs; 2: Comparable to unskilled blue-collar or service jobs; 1: Among the least respected, such as slaves or indentured servants.

A.3.5.6 Proportion of Nonresident Employment

Rationale: The ability of a country or region to improve itself using its resources depends on its ability to maintain local multipliers by keeping wealth within the region. A large portion of nonresident processing workers reflects that much of the processing wealth will be leaving the region, failing to boost the regional economy.

Proposed Measure: 5: 95 to 100 percent local; 4: 71 to 95 percent local; 3: 36 to 70 percent local; 2: 5 to 35 percent local; 1: Virtually no local harvesters.

A.3.5.7 Worker Experience

Rationale: The rate at which workers turn over in the fishery is an indirect measure of several key variables. First, it reflects wealth accumulation to workers, because a worker will only stay in the fishery if the wage is comparable to, or better than, other jobs he could obtain. Second, worker longevity often means the workers are resident in the community, and thus their earnings stay in the community and are spent locally, rather than being sent away by itinerant or immigrant workers. Third, experienced workers develop specialized knowledge and refined skills that make processing more efficient, so the fishery is better able to reach its wealth-generating potential.

Proposed Measure: Average years of experience of workers. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: More than 20 years (skilled career workers); 4: 5 to 20 years; 3: 3 to 5 years; 2: 1 to 3 years; 1: 0 full years of experience (mostly new workers each season).

FISHERY PERFORMANCE FACTORS: INPUTS

A.4 MACRO FACTORS

A.4.1 General Environmental Performance

A.4.1.1 Environmental Performance Index (EPI)

Rationale: Wealth creation is dependent on the general condition of the environment. An Environmental Performance Index (EPI) has been developed to evaluate: 1) environmental health and 2) ecosystem vitality (Esty et al. 2008).

Proposed Measure: The EPI considers factors such as disease, water quality, air pollution, biodiversity, natural resources, and climate change. The EPI ranges from 1 to 100: 5: EPI of 81 to 100; 4: 61 to 80; 3: 41 to 60; 2: 21 to 40; 1: 1 to 20.

A.4.2 Exogenous Environmental Factors

A.4.2.1 Disease and Pathogens

Rationale: Even a well-managed fishery can fail to accumulate wealth if exogenous events or conditions threaten the stock, or the harvestability of the stock. This measure is intended primarily to identify when other management inputs will not be correlated with outcomes for reasons exogenous to the fishery.

Proposed Measure: Measure is based on the extent to which harvest is thought to be adversely affected by exogenous disease, pathogens, toxic algaes, or similar factors: 5: Harvest unaffected by disease; 4: Harvest reduced by less than 10 percent; 3: Harvest reduced by 10 to 30 percent; 2: Harvest reduced by more than 30 percent; 1: Harvest almost completely eliminated by shocks.

A.4.2.2 Natural Disasters and Catastrophes

Rationale: Even a well-managed fishery can fail to accumulate wealth if exogenous events or conditions threaten the stock, or the harvestability of the stock. This measure is intended primarily to identify when other management inputs will not be correlated with outcomes for reasons exogenous to the fishery.

Proposed Measure: Measure is based on the extent to which harvest is thought to be adversely affected by natural disasters such as earthquakes, volcanoes, tsunamis, hurricanes, and typhoons. These are typically one-time events, not long-term ecosystem scale shifts induced by climate change: 5: Harvest unaffected by disaster; 4: Harvest reduced by less than 10 percent; 3: Harvest reduced by 10 to 30 percent; 2: Harvest reduced by more than 30 percent; 1: Harvest almost completely eliminated by disaster.

A.4.2.3 Pollution Shocks and Accidents

Rationale: Even a well-managed fishery can fail to accumulate wealth if exogenous events or conditions threaten the stock, or the harvestability of the stock. This measure is intended primarily to identify when other management inputs will not be correlated with outcomes for reasons exogenous to the fishery.

Proposed Measure: Measure is based on the extent to which harvest is thought to be adversely affected by pollution shocks, such as oil spills, industrial accidents, or peak runoff events. These are typically one-time events, not chronically high levels of pollution: 5: Harvest unaffected by pollution; 4: Harvest reduced by less than 10 percent; 3: Harvest reduced by 10 to 30 percent; 2: Harvest reduced by more than 30 percent; 1: Harvest almost completely closed by shocks.

A.4.2.4 Level of Chronic Pollution—Stock Effect

Rationale: Even a well-managed fishery can fail to accumulate wealth if exogenous events or conditions threaten the stock, or the harvestability of the stock. This measure is intended primarily to identify when other management inputs will not be correlated with outcomes for reasons exogenous to the fishery.

Proposed Measure: Measure is based on the level of chronic pollution that is detected in the fishery. Chronic pollution can be either always present, or frequently recurring, such as after each moderate rainfall: 5: Not detectable; 4: Minimal detectable levels; 3: Major detectable; 2: Pollution affects stock growth; 1: Pollution leading to severe stock decline.

A.4.2.5 Level of Chronic Pollution—Consumption Effect

Rationale: Even a well-managed fishery can fail to accumulate wealth if exogenous events or conditions threaten the stock, or the harvestability of the stock. This measure is intended primarily to identify when other management inputs will not be correlated with outcomes for reasons exogenous to the fishery.

Proposed Measure: Measure is based on the level of chronic pollution that is detected in the fishery. Chronic pollution can be either always present, or frequently recurring, such as after each moderate rainfall: 5: No consumption affected; 4: Minimal consumption affected; 3: Official consumption advisories; 2: Temporarily ban harvest for consumption; 1: Completely closed for consumption.

A.4.3 Governances

A.4.3.1 Governance Indicator—Effectiveness

Rationale: Good governance is an essential condition for sustainable fisheries and wealth creation. The World Bank has developed a Worldwide Governance Indicator which considers six dimensions: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption (Kaufman et al. 2008).

Proposed Measure: The Governance Indicators (Kaufman, Kraay, and Mastruzzi 2008) assign countries to ranks based on six dimensions. This measure is the average percentile ranking of the Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption indicators. Assign average percentile to a quintile and give points according to: 5: First quintile; 4: Second quintile; 3: Third quintile; 2: Fourth quintile; 1: Fifth quintile.

A.4.3.2 Governance Indicator—Voice and Accountability

Rationale: Good governance is an essential condition for sustainable fisheries and wealth creation. The World Bank has developed a Worldwide Governance Indicator that considers six dimensions: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption (Kaufman et al. 2008).

Proposed Measure: The Governance Indicators (Kaufman et al. 2008) assign countries to ranks based on six dimensions. This measure is the average percentile ranking of the Voice and Accountability and Political Stability indicators. Assign average percentile to a quintile and give points according to: 5: First quintile; 4: Second quintile; 3: Third quintile; 2: Fourth quintile; 1: Fifth quintile.

A.4.4 Economic Conditions

A.4.4.1 Index of Economic Freedom

Rationale: Wealth creation is dependent on the institutional setting and economic conditions in a given country. The Heritage Foundation/*Wall Street Journal*, Index of Economic Freedom (IEF) reflects the overall economic freedom of the nation within which the fishery sector operates (Miller and Holmes 2009). The Index of Economic Freedom includes 10 broad institutional factors: Business freedom; Trade freedom; Fiscal freedom; Government size; Monetary freedom; Investment freedom; Financial freedom; Property rights; Freedom from corruption; and Labor freedom. Construction of the index relies on several other studies for its data sources, including the World Bank's Doing Business Economist Intelligence Unit (The World Bank 2009a), the U.S. Department of Commerce, the World Bank's *World Development Indicators* (The World Bank, 2009b), Eurostat, International Monetary Fund reports, Transparency

International's, Corruption Perceptions Index (Transparency International 2009), and several other documents.

Proposed Measure: The 10 factors are equally weighted and the final composite index has a range from 1 to 100. A detailed discussion of these factors and methodology is found in Miller and Holmes (2009): 5: IEF of 81 to 100; 4: 61 to 80; 3: 41 to 60; 2: 21 to 40; 1: 1 to 20.

A.4.4.2 Gross Domestic Product (GDP) Per Capita

Rationale: Richer nations are more likely able to afford the institutions and technological factors that are necessary for wealth creation.

Proposed Measure: Bin boundaries based on quintiles of the U.S. CIA's rank of per capita GDP of all countries (https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html): 5: Greater than US$30,000; 4: Greater than US$12,400; 3: Greater than US$6,000; 2: Greater than US$2,500; 1: Less than US$2,500.

A.5 PROPERTY RIGHTS AND RESPONSIBILITY

A.5.1 Access

A.5.1.1 Proportion of Harvest Managed Under Limited Access

Rationale: Limited-access fisheries are an essential step in eliminating the open-access common property problem of rent dissipation.

Proposed Measure: The proportion of total harvest that is under limited-access fishing regulation: 5: Virtually all; 4: 71 to 95 percent; 3: 36 to 70 percent; 2: 5 to 35 percent; 1: Virtually none.

A.5.1.2 Transferability Index

Rationale: Transferability is essential for a functioning market to allocate resources to their best use. If rights are not transferable, financing is undermined because the property may not be accepted as collateral. If the markets for the rights are not efficient, then the value of the right will not be transparent, and its price will not necessarily reflect the value. This will lead to misallocation of resources and inefficiencies, as well as undermine sustainability and wealth creation (Anderson 2007, 2002).

Proposed Measure: 5: Very strong: fully transferable through well-established, efficient market institutions; 4: Strong: fully transferable, but institutions are poor or illiquid; 3: Moderate: transferable, but with severe restrictions on who can hold, or how much; 2: Weak: transferable only under highly restricted and limited condition; 1: Access rights not transferable.

A.5.1.3 Security Index

Rationale: When property rights are insecure, regardless of whether the reason is crime, civil unrest, war, government instability, or government's use of eminent domain, it causes owners to be more exploitive with resources. Uncertainty implicitly increases the discount rate. Financing is undermined (Anderson 2007, 2002).

Proposed Measure: Extent to which the government reduces or dilutes the access rights: 5: Very Strong: Access rights are completely respected and are not diluted (e.g., by issuing more access rights) by the government; 4: Strong: Rights are mostly respected by the government; generally survive changes in government administration; 3: Moderate: Rights are at risk of retraction or dilution with changes in administration; 2: Weak: Rights are highly diluted or there is high political uncertainty; 1: None: Access rights are not protected.

A.5.1.4 Durability Index

Rationale: Short-duration property rights create more exploitive management. This implicitly increases the discount rate, thus undermining sustainability and wealth creation (Anderson 2007, 2002).

Proposed Measure: Duration of the property right: 5: Very Strong: >10 years to perpetuity; 4: Strong: 5 to 10 years; 3: Moderate: 1 to 5 years; 2: Weak: Seasonal; 1:None: None/daily.

A.5.1.5 Flexibility Index

Rationale: Under strong property rights all decisions regarding use, management, and technology employed to extract value from the property are controlled by the owner. Fishing time, gear, and handling practices are in the owner's control.

Proposed Measure: Ability of right holders to be flexible in the timing and production technology employed: 5: Very Strong: All decisions on time of harvest, gear used, and handling practices are in the owner's control; 4: Strong: Minimal restrictions on time of harvest and technology; 3: Moderate: Modest restrictions on time of harvest and technology; 2: Weak: Significant restrictions on time of harvest and technology; 1: Time of harvest, gear used, and handling practices are not in the owner's control.

A.5.1.6 Exclusivity Index

Rationale: Under strong property rights all decisions and access to the property are controlled by the owner. With well-defined rights, externalities are internalized and net benefits are captured. Those that produce externalities that infringe on the property right are held responsible. If externalities are not internalized, costs are undervalued, market signals are

biased, resources are misallocated, and sustainability and wealth creation are undermined (Anderson 2007, 2002).

Proposed Measure: Ability of right holders to exclude those who do not have the right from affecting the resource or market: 5: Very Strong: All decisions and access to the property are controlled by the right's owner (rather than those without rights, competing resource users [like recreational or by-catch fisheries]); 4: Strong: Little intrusion on resource by those without rights; 3: Moderate: Modest intrusion on resource by those without rights; 2: Weak: Significant intrusion on resource by those without rights; 1: None: Completely unrestricted open access, despite putative right.

A.5.2 Harvest Rights

A.5.2.1 Proportion of Harvest Managed with Rights-Based Management

Rationale: Rights-based management (beyond simple access), such as Individual/Community Quotas, Catch Shares or Territorial Use Rights (TURFs), induce economic incentives to allocate resources efficiently and generate wealth.

Proposed Measure: The proportion of total harvest that is under rights-based fisheries management (e.g., Individual/Community Quotas, Catch Shares or Territorial Use Rights [TURFs]): 5: Virtually all; 4: 71 to 95 percent; 3: 36 to 70 percent; 2: 5 to 35 percent; 1: Virtually none.

A.5.2.2 Transferability Index

Rationale: Transferability is essential for a functioning market to allocate resources to for their best use. If rights are not transferable, financing is undermined because the property may not be accepted as collateral. If the markets for the rights are not efficient, then the value of the right will not be transparent, and its price will not necessarily reflect the value. This will lead to misallocation of resources and inefficiencies, as well as undermine sustainability and wealth creation (Anderson 2002, 2007).

Proposed Measure: 5: Very strong: fully transferable through well-established, efficient market institutions; 4: Strong: fully transferable, but institutions are poor or illiquid; 3: Moderate: transferable, but with severe restrictions on who can hold, or how much; 2: Weak: transferable only under highly restricted and limited condition; 1: Access rights not transferable.

A.5.2.3 Security Index

Rationale: When property rights are insecure, regardless of whether the reason is crime, civil unrest, war, government instability, or government's use of eminent domain, it causes owners to be more exploitive with resources. Uncertainty implicitly increases the discount rate. Financing is undermined (Anderson 2002, 2007).

Proposed Measure: 5: Very Strong: Harvest rights are completely respected and are not diluted (e.g., by issuing more harvest rights) by the government; 4: Strong: Rights are mostly respected by the government; generally survive changes in government administration; 3: Moderate: Rights are at risk of retraction or dilution with changes in administration; 2: Weak: Rights are highly diluted or there is high political uncertainty; 1: None: Harvest rights are not protected

A.5.2.4 Durability Index

Rationale: Short-duration property rights create more exploitive management. This implicitly increases the discount rate, thus undermining sustainability and wealth creation (Anderson 2002, 2007).

Proposed Measure: Duration of the property right: 5: Very Strong: >10 years to perpetuity; 4: Strong: 5 to 10 years; 3: Moderate: 1 to 5 years; 2: Weak: Seasonal; 1:None: None/daily.

A.5.2.5 Flexibility Index

Rationale: Under strong property rights all decisions regarding use, management, and technology employed to extract value from the property are controlled by the owner. Fishing time, gear, and handling practices are in the owner's control.

Proposed Measure: Ability of right holders to be flexible in the timing and production technology employed: 5: Very Strong: All decisions on time of harvest, gear used, and handling practices are in the owner's control; 4: Strong: Minimal restrictions on time of harvest and technology; 3: Moderate: Modest restrictions on time of harvest and technology; 2: Weak: Significant restrictions on time of harvest and technology; 1: Time of harvest, gear used, and handling practices are not in the owner's control

A.5.2.6 Exclusivity Index

Rationale: Under strong property rights all decisions and access to the property are controlled by the owner. With well-defined rights, externalities are internalized and net benefits are captured. Those that produce externalities that infringe on the property right are held responsible. If externalities are not internalized, costs are undervalued, market signals are biased, resources are misallocated, and sustainability and wealth creation are undermined (Anderson 2002, 2007).

Proposed Measure: Ability of right holders to exclude those who do not have the right from affecting the resource or market: 5: Very Strong: All decisions and access to the property

are controlled by the right's owner (rather than those without rights, competing resource users [like recreational or by-catch fisheries]); 4: Strong: Little intrusion on resource by those without rights; 3: Moderate: Modest intrusion on resource by those without rights; 2: Weak: Significant intrusion on resource by those without rights; 1: None: Completely unrestricted open access, despite putative right.

A.5.3 Comanagement

A.5.3.1 Participation in Industry Organizations

Rationale: The degree to which producers are organized into cooperatives or associations that can act collectively to influence distribution/sharing of resources and facilitate both buying and selling power, thereby creating wealth enhancement.

Proposed Measure: Proportion of harvest where the primary harvesters are organized into associations: 5: Virtually all; 4: 71 to 95 percent; 3: 36 to 70 percent; 2: 5 to 35 percent; 1: Virtually none.

A.5.3.2 Industry Organization Influence on Management and Access

Rationale: Harvesting organizations can influence management and access by directly managing access rights (e.g., cooperatives or community quota systems) or by taking political action to influence the access they and others have through the management authority. Such harvester participation may facilitate management that increases wealth accumulation to harvesters.

Proposed Measure: Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on management and access to the fishery: 5: Harvesters effectively determine allocation of resources; 4: Harvesters have significant influence in determining allocation; 3: Harvesters are politically active, but not controlling; 2: Social or informal monitoring participation and allocation; 1: No active effort or capacity to influence management.

A.5.3.3 Harvester Organization Influence on Business and Marketing

Rationale: Harvesting organizations can influence business and marketing by working to exert market power in either purchasing of inputs (e.g., marine services or insurance) or by collectively marketing products, reducing costs, or increasing revenue, respectively. Such joint activity may increase wealth accumulation to harvesters.

Proposed Measure: Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on management and access to the fishery: 5: Harvesting organizations cooperatively determine marketing and operational details; 4: Extensive joint marketing; 3: Large subgroups facilitating marketing, joint purchasing; 2: Small subgroups cooperating in purchasing or operations; 1: No active effort or capacity to influence business operations.

A.5.4 Management

A.5.4.1 Management Expenditure to Value of Harvest

Rationale: This is a measure of the cost of fisheries management in proportion to the value of fisheries. Efficiency in management is essential for wealth creation.

Proposed Measure: This measure divides the budget ($ million) for fisheries management by the ex-vessel value ($ millions) of the harvest. Government, industry, and aid agency expenditures on fishery management activities include research, enforcement, and management capacity development (but not infrastructure). Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table, which are based on the benchmark of managed mutual funds (1 to 2 percent management costs): 5: Less than 5 percent; 4: 5 to 25 percent; 3: 26 to 50 percent; 2: 51 to 100 percent; 1: More than the value of harvest.

A.5.4.2 Management Employees to Value of Harvest

Rationale: This is an indicator of management efficiency. Efficient management is essential for wealth creation.

Proposed Measure: Public sector fishery management employee FTEs devoted to managing the fishery divided by the ex-vessel value of the harvest. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: More than 0.35 per million; 4: 0.25 to 0.35; 3: 0.15 to 0.25; 2: 0.01 to 0.15; 1: 0.

A.5.4.3 Management Employees per Permit Holder

Rationale: This is an indicator of management efficiency. Efficient management is essential for wealth creation.

Proposed Measure: Fishery management FTE employees divided by the number of fishing units (in 100s) (vessels or permit holders). Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following: 4 or more per 100 permit holders; 3; 2; 1; 0.

A.5.4.4 Research as a Proportion of Fisheries Management Budget

RATIONALE: This is an indicator of the degree to which fishery management is based on science. It is also an indicator of the potential for innovation and support for entrepreneurs.

PROPOSED MEASURE: Research expenditures divided by total fisheries management budget. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table (based on 18 to 22 percent in pharmaceuticals and 4 percent in general manufacturing): 5: Over 20 percent; 4: 12 to 20 percent; 3: 5 to 12 percent; 2: 0.5 to 5 percent; 1: Virtually none.

A.5.4.5 Level of Subsidies

RATIONALE: Subsidies distort resource allocation and pricing. Lower subsidies are indicative of greater market efficiency. Subsidies include preferential tax rates, input cost reductions, price supports, special borrowing rates, undervaluing resources (e.g., leases), payments-in-kind, and other related actions giving preference.

PROPOSED MEASURE: Measure the annual value of all subsidies as a proportion of the value of the fishery: 5: Near zero (less than 2.5 percent); 4: 2.5 to 7.5 percent; 3: 7.5 to 12.5 percent; 2: 12.5 to 20 percent; 1: More than 20 percent.

A.5.5 Data

A.5.5.1 Data Availability

RATIONALE: A fishery management program will be more effective in achieving its social and biological goals if it collects data on which to evaluate policy changes, either retrospectively or prospectively.

PROPOSED MEASURE: 5: Regular stock assessment and economic data; 4: Landings and price data; 3: Landings data; 2: Boat registration and license data; 1: No data are tracked

A.5.5.2 Data Analysis

RATIONALE: A fishery management program will be more effective in achieving its social and biological goals if it analyzes data to evaluate policy changes, either retrospectively or prospectively.

PROPOSED MEASURE: 5: Biological and economic data used in prospective analysis of management; 4: Biological data dominate simple prospective analysis; 3: Biological or economic data are used to track performance retrospectively; 2: Data are used inconsistently or irregularly; 1: No data analysis conducted in management process.

A.5.6 Participation

A.5.6.1 Days in Stakeholder Meetings

RATIONALE: This measure is a proxy for the efficiency of the management process and stakeholder participation. Stakeholder participation injects stakeholders' knowledge into management and may increase legitimacy and compliance. However, it may also increase management costs and present opportunities for lobbying and rent seeking that increases the time required to implement management, or weakens implemented regulations to prevent wealth generation.

PROPOSED MEASURE: Days in stakeholder meetings per year spent by an participant in the fishery who is active in management. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table: 5: More than 24 per year; 4: 12 to 24; 3: 6 to 12; 2: 1 to 6; 1: None.

A.5.6.2 Industry Financial Support for Management

RATIONALE: If the industry pays for the cost of management, it is likely that efficiency will be improved and the concomitant control over management exerted by the industry will lead to improved outcomes for harvesters, especially wealth generation.

PROPOSED MEASURE: Proportion of the fishery management budget paid for by the fishing sector. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following: 5: Virtually all; 4: 50 to 95 percent; 3: 6 to 50 percent; 2: 1 to 5 percent; 1: None.

A.6 POST-HARVEST

A.6.1 Markets and Market Institutions

A.6.1.1 Landings Pricing System

RATIONALE: Fair and efficient price discovery systems are essential for efficient resource use and wealth creation. Crucial to this is the ability of harvesters to move among ex-vessel buyers to those offering the best prices on a per-landing basis.

PROPOSED MEASURE: Proportion of the harvest sold in a transparent daily competitive pricing mechanism, such as an auction or centralized ex-vessel to wholesale market: 5: Virtually all; 4: 71 to 95 percent; 3: 36 to 70 percent; 2: 5 to 35 percent; 1: Virtually none.

A.6.1.2 Availability of Ex-vessel Price and Quantity Information

RATIONALE: Market transparency is essential for efficient resource use and wealth creation. Market transparency is characterized by readily available, accurate price and quantity information.

PROPOSED MEASURE: 5: Complete, accurate price and quantity information available to market participants immediately; 4: Reliable price and quantity information is available prior to the next market clearing; 3: Price information is available but no timely quantity information; 2: Price and quantity information are inaccurate, lagged, or available to only a few; 1: No information available.

A.6.1.3 Number of Buyers

RATIONALE: This measure is an indicator of relative market power. If the market is dominated by a single (or very few) buyer or seller, price will favor the side with greater market power.

PROPOSED MEASURE: Typical number of buyers of ex-vessel product in a given market: 5: Highly competitive; 4: 4 to 6 buyers; 3: 2 to 3 competing buyers; 2: A small number of coordinating buyers; 1: There is one buyer.

A.6.1.4 Degree of Vertical Integration

RATIONALE: Vertical integration facilitates the flow of information from the consumer to the harvest sector and tends to reduce transaction costs between market levels.

PROPOSED MEASURE: Proportion of harvest where the primary harvester and primary processor/distributor are same firm. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following: 5: Virtually none; 4: 0.5 to 2.5 percent; 3: 2.5 to 5 percent; 2: 5 to 10 percent; 1: Over 10 percent.

A.6.1.5 Level of Tariffs

RATIONALE: Lower tariffs broaden the market, improve price discovery, and increase the opportunity to create wealth.

PROPOSED MEASURE: Based on quintile once data on an appropriate number of systems are collected. However, initial tariff rate on key seafood exports relative to international average for food commodities. Bin boundaries can be established by quintile once data are collected on many fisheries. For the pilot studies, the boundaries will be coarsely established by the following table (based on World Development Indicators 2005 Table 6.3, average 2003 tariff for food from low-income countries to OECD countries is 4.1 percent).

A.6.1.6 Level of Nontariff Barriers

RATIONALE: Lower nontariff barriers broaden the market, improve price discovery, and increase the opportunity to create wealth.

PROPOSED MEASURE: Nontariff barriers include quantity restrictions (import quotas), regulatory restrictions, investment restrictions, customs restrictions, and direct government intervention: 5: Are not used to limit international trade; 4: Have very limited impact on international trade; 3: Act to impede some international trade; 2: Act to impede a majority of potential international trade; 1: Act to effectively impede a significant amount of international trade

A.6.2 Infrastructure

A.6.2.1 International Shipping Service

RATIONALE: In order to have access to a broader market, competitively priced international shipping is essential.

PROPOSED MEASURE: Average of the two measures below:

5: Ocean shipping services are readily available at lower than average rates; 4: Ocean shipping services are readily available at average rates; 3: Ocean shipping services are readily available at higher than average rates; 2: Ocean shipping services are available but irregular; 1: International shipping is not available at reasonable rates

5: Air shipping services are readily available at lower than average rates; 4: Air shipping services are readily available at average rates; 3: Air shipping services are readily available at higher than average rates; 2: Air shipping services are available but irregular; 1: International shipping is not available at reasonable rates.

A.6.2.2 Road Quality Index

RATIONALE: The quality of roads is directly related to the ability of firms to distribute their products, minimize transportation cost, and create wealth.

PROPOSED MEASURE: Mile-weighted average road quality between the fishery's primary port and its major consumption center (or export shipping port for exported product). Score according to: 5: High-quality paved roads and extensive highways; 4: Primarily paved two-lane roads and moderate highway; 3: Primarily paved two-lane roads and minimal highway; 2: Paved two-lane roads and well-graded gravel roads; 1: Poorly maintained gravel or dirt roads.

A.6.2.3 Technology Adoption

RATIONALE: The availability of the latest communication, processing, and production technology is important for firms to maintain global competitiveness and create wealth.

Proposed Measure: 5: Cell phones/fish finders/computers/processing/production technology are readily available; 4: Cell phones/fish finders, and so forth, are common, but some other technology is not always available; 3: Cell phones/fish finders, and so forth, are common, but some other technology is difficult to obtain; 2: Cell phones are common, but most other technology is prohibitive; 1: Very little advanced technology is accessible for the industry.

A.6.2.4 Extension Service

Rationale: Extension services are successful in many countries for transferring technology and information about best management practices, new technology, market conditions, and regulatory changes. This information is often essential in a widely dispersed industry to help maximize returns and generate wealth.

Proposed Measure: 5: Broad extension service with field offices and close linkage with research community; 4: Extension service with moderate field coverage and adequate linkage with the research community; 3: Extension service, but with weak links to the research community; 2: Minimal, poorly supported extension service; 1: No extension service.

A.6.2.5 Reliability of Utilities/Electricity

Rationale: Reliable utilities are essential for firms to function efficiently and generate wealth.

Proposed Measure: 5: Electricity readily available with rare outages; 4: Electricity readily available with less than six short outages per year; 3: Electricity readily available with less than two outages per month; 2: Electricity readily available with more than two outages per month; 1: Electricity is not available except through generators.

A.6.2.6 Access to Ice and Refrigeration

Rationale: Ice/refrigeration are essential for quality control and broadening the market.

Proposed Measure: 5: Ice is readily available in various forms; 4: Ice is readily available in various forms with occasional shortages; 3: Ice is available in limited quantity/form (e.g., block only); 2: Ice is available in very limited quantity/form; 1: Ice is unavailable.

Appendix B: SUGGESTED REVISION AND ADDITIONAL INDICATORS

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Ecologically Sustainable Fisheries	Fish Stock Health and Environmental Performance	Proportion of Harvest with a Third-Party Certification	• **5**: 76–100% of landings are certified • **4**: 51–75% of landings are certified • **3**: 26–50% of landings are certified • **2**: 1–25% of landings are certified • **1**: No landings have third-party certification	The proportion of harvest (quantity) harvested under one of the recognized third-party programs that certify ecological sustainability, such as the Marine Stewardship Council (MSC) certification.
		Percentage of Stocks Overfished	• **5**: None overfished • **4**: 1–25% of stocks overfished • **3**: 26–50% overfished • **2**: 51–75% overfished • **1**: 76–100% overfished	Proportion of stocks in the fishery (including distinct stocks of the same species under the same management plan) whose current biomass level indicates they are overfished. Single species fisheries will be 1 or 5. (Whether they are currently recovering or being overfished further is the next question.)
		Overfishing or Rebuilding	• **5**: Stock is not overfished or is rebuilt • **4**: Growth overfished, but stable or rebuilding • **3**: Growth overfished and experiencing growth overfishing • **2**: Recruit overfished, but stable or rebuilding • **1**: Recruit overfished and experiencing recruit overfishing	Extent to which current effort affects stock status. For multistock fisheries, score each significant stock 1 to 5, then take a value-weighted average.
		Regulatory Mortality	• **5**: No regulatory mortality of the target species • **4**: Regulatory mortality is less than 5% of total catch • **3**: 5–25% • **2**: 25–50% • **1**: For every 100 lbs of fish caught, more than 50 lbs are discarded	Nonlanding mortality induced by regulation, such as regulatory discards
		Selectivity	• **5**: There is virtually no nontarget catch • **4**: Less than 5% of catch is of nontarget species • **3**: 5–25% • **2**: 25–50% • **1**: For every 100 lbs of fish caught, more than 50 lbs are nontarget species	Nontarget species are distinct from multispecies fisheries in that the catch of nontarget species does not increase the value of fishing, or impose costs on the target fishery.
		Illegal, Unregulated, or Unreported Landings	• **5**: There is virtually no IUU catch • **4**: Less than 5% of catch is IUU • **3**: 5–25% • **2**: 25–50% • **1**: For every 100 lbs of fish caught, more than 50 lbs are IUU	Proportion of landings using illegal gear, area, methods, and so forth, or falling outside of the regulations. If there is no regulatory reporting requirement, that does not count as unreported for purposes of this measure.
		Status of Critical Habitat	• **5**: Critical habitat is healthy and not threatened • **4**: Less than 25% is degraded or dysfunctional • **3**: 25–75% is degraded or dysfunctional • **2**: More than 75% of critical habitat is destroyed • **1**: Nearly all critical habitat is damaged or dysfunctional	Critical habitat is defined as that playing a significant role in the life cycle of the fish. Portion damaged is based on area, and from all sources of damage including fishing damage, pollution, and development.

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Harvest Sector Performance	Harvest Performance	Landings Level	• **5**: Harvest is less than MSY (stock is above MSY level) to increase profit • **4**: Harvest is approximately at MSY • **3**: Harvest reduced to promote recovery (stock is below MEY level) • **2**: Harvest is constraining stock recovery (stock is stable below MEY level) • **1**: Harvest is causing overfishing (stock is below MEY and declining)	Average annual harvest over the last 3 years. In practice, there are very few estimates of MEY, however where it has been calculated it is typically 5 to 10 percent less than maximum sustainable yield (MSY).
		Excess Capacity	• **5**: Within 5% of days required • **4**: 105–120 or 90–95% • **3**: 120–150% or 75–90% • **2**: 150–200% or 50–75% • **1**: More than 200%, or less than 50%, of days required	In the absence of a fishery-specific measure of overfishing, use estimated standardized vessels-days required to catch the maximum economic yield (MEY) compared to the number of standardized vessel-days available. Days are considered not to be restricted by trip limits.
		Season Length	• **5**: Virtually no regulatory closures • **4**: 90–99% • **3**: 50–90% • **2**: 10–50% • **1**: Less than 10%	Ratio of number of days on which fishing occurs to the number of days the species is available in economically feasible quantities. This is primarily a measure of the extent of derby (including short regulatory seasons to limit total effort), not lack of biological availability or closures to prevent within-season growth overfishing.
		Harvest Safety	• **5**: Less than 0.1 deaths per thousand person seasons • **4**: Less than 0.5 deaths • **3**: Less than 1 • **2**: Less than 5 • **1**: More than 5 deaths per thousand person seasons	Number of harvester (captain or crew) on-the-job deaths, per thousand person fishing season. We consider there to be one season per year, but do not annualize mortality if the fishing season is less than a year.
	Harvest Asset Performance	Ratio of Asset Value to Gross Earnings	• **5**: 10 or higher • **4**: 7.5–10 • **3**: 5–7.5 • **2**: 2.5–5 • **1**: Below 2.5	Extent to which fishery wealth is accumulated in access capital (e.g., quota or vessels). Typically a 1 if vessels or quota not limited by regulation. Ratio of average price of capital and licenses require access to the fishery over the last 5 years to the average annual landings value for a similarly scaled access right in the same period. Same business or same family sales are excluded, where they can be identified.
		Total Revenue versus Historic High	• **5**: Above 95% • **4**: 85–95% • **3**: 70–85% • **2**: 50–70% • **1**: Below 50%	The indicator is the ratio of total real revenue (in local currency) to the average of the three highest total real revenues in the past 10 years. Adjust by local CPI if inflation was significant.
		Asset (Permit, Quota) Value versus Historic High	• **5**: Above 95% • **4**: 85–95% • **3**: 70–85% • **2**: 50–70% • **1**: Below 50%	The indicator is the ratio of asset to the average of the three highest asset values in the past 10 years. Adjust by local CPI if inflation was significant. Typically 5 if wealth is not accumulating in vessels, permits, or quota.
		Borrowing Rate Relative to Risk-Free Rate	• **5**: Less than 1.75; cf. 30-year conforming mortgage; family/friend's support • **4**: Less than 2.5; cf. personal bank loan; in-kind pay back • **3**: Less than 4; cf. good credit card rates • **2**: Less than 7; cf. bad credit card rates • **1**: Greater than 7; usury	Average ratio between the interest rate on loans made in the industry to risk-free rates over the last 3 years. If businesses can access the international credit markets, that is appropriate comparison; otherwise, use local risk-free rate.

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Source of Capital	• **5**: Unsecured business loans from banks/venture capital • **4**: Secured business loans from banks/public stock offering; investment from elsewhere in supply chain • **3**: Loans from banks secured by personal (not business) assets/government-subsidized private lending/government-run loan programs/international aid agencies; secured loans from elsewhere in supply chain • **2**: Microlending/family/community-based lending; loans from supply chain significantly reduce margins • **1**: Mafia/no capital available; exploitive relationship from elsewhere in supply chain	Points to be assigned based on the category of lenders or investors that is most typically used in the fishery. Second scoring method offered if the supply chain (e.g., traders, processors, exporters) are primary source of capital.
		Functionality of Harvest Capital	• **5**: Capital is new • **4**: Capital is older but well maintained, e.g., freshly painted • **3**: Capital is moderately well maintained • **2**: Maintenance is poor • **1**: Serious concerns about seaworthiness or safety throughout fishery	Average age of the key durable harvesting capital unit (vessels, weirs). Ages are not assigned to scores due to differences in expected useful life, but buildings and industrial vessels have expected life of roughly 20 years.
	Risks Exposure	Annual Total Revenue Volatility	• **5**: Less than 0.15 • **4**: 0.15–0.22 • **3**: 0.22–0.40 • **2**: 0.40–1 • **1**: Greater than 1	Ratio of the standard deviation of the first differences of annual total revenue to the mean total revenue over the last 10 years. Best guess may be calculated based on shorter time series if data not available.
		Annual Landings Volatility	• **5**: Less than 0.15 • **4**: 0.15–0.22 • **3**: 0.22–0.40 • **2**: 0.40–1 • **1**: Greater than 1	Ratio of the standard deviation of the first differences of annual total landings sold to the mean landings over the last 10 years.
		Intra-annual Landings Volatility	• **5**: Less than 0.15 • **4**: 0.15–0.22 • **3**: 0.22–0.40 • **2**: 0.40–1 • **1**: Greater than 1	Ratio of the standard deviation of the weekly/monthly total sold landings over the last 3 years to the mean landings. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is not meaningful variation at a monthly level, this measure can be NA.
		Annual Price Volatility	• **5**: Less than 0.13 • **4**: 0.13–0.20 • **3**: 0.20–0.30 • **2**: 0.30–0.85 • **1**: Greater than 0.85	Ratio of the standard deviation of the first differences of annual ex-vessel price to the mean price over the last 10 years.
		Intra-annual Price Volatility	• **5**: Less than 0.13 • **4**: 0.13–0.20 • **3**: 0.20–0.30 • **2**: 0.30–0.85 • **1**: Greater than 0.85	Ratio of the standard deviation of average monthly ex-vessel price over the last 3 years to the mean. Observations of zero landings are included if there is biological availability. If the biological season is so short that there is not meaningful variation at a monthly level, this measure can be NA.
		Spatial Price Volatility	• **5**: Less than 0.13 • **4**: 0.13–0.20 • **3**: 0.20–0.30 • **2**: 0.30–0.85 • **1**: Greater than 0.85	Ratio of the standard deviation across data collection regions of average annual ex-vessel price to the mean. Measure should be averaged over last 3 years.

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Contestability and Legal Challenges	• **5**: No significant legal challenges, civil actions, or protests regarding the fishery management system • **4**: Minor legal challenges slow implementation • **3**: Legal challenges, civil actions, or protests impede some management measures • **2**: Legal challenges, civil actions, or protests suspend major elements of the management system • **1**: Legal challenges, civil actions, or protests suspend or prohibit implementation of key management reforms and regulation certification	This captures the degree to which political activity limits the ability to implement effective fishing regulations.
	Owners, Permit Holders, and Captains (Those Holding the Right or Ability to Access)	Earnings Compared to Regional Average Earnings	• **5**: More than 50% above the regional average • **4**: Between 10% and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of annual earnings from fishing per owner to the regional average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew.
		Fishery Wages Compared to Nonfishery Wages	• **5**: More than 50% above the regional average • **4**: Between 10 and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of captain's average daily wage in this fishery to average daily wage in the captain's economic sphere (e.g., village if all economic activity is within the village, but nation if participates in national markets as a consumer). May differ from above measure if fishery is not year-round and there is no income or income from other fisheries or other occupations.
		Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic training is accessible • **1**: Formal education is not accessible	The level of education attained by (available and affordable) the families (i.e., children) of permit holders and captains.
		Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	The level of health care accessible to (available and affordable) the families of permit holders and captains.
		Social Standing of Boat Owners and Permit Holders	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue-collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
		Proportion of Nonresident Employment	• **5**: 95–100% local • **4**: 70–95% local • **3**: 35–70% local • **2**: 5–35% local • **1**: Virtually no local permit holders	"Local" is defined as coming from, and spending their earnings within, the local fishing community. Nationals who are transient nonresidents or considered outsiders in the fishing community are not local.

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
	Crew (Those Depending on Others for Access)	Earnings Compared to Regional Average Earnings	• **5**: More than 50% above the regional average • **4**: Between 10% and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of annual earnings from fishing per crew to the regional average earnings. In many cases, the captain is an owner of a vessel or permit, but in other cases, captains are considered as crew.
		Fishery Wages Compared to Nonfishery Wages	• **5**: More than 50% above the regional average • **4**: Between 10% and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of crew's average daily wage to average daily wage in the crew's economic sphere (e.g., village if all economic activity is within the village, but nation if participates in national markets as a consumer). May differ from above measure if fishery is not year-round and there is no income or income from other fisheries or other occupations.
		Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic training is accessible • **1**: Formal education is not accessible	The level of education attained by (available and affordable) the families (i.e., children) of crew.
		Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	The level of health care accessible to (available and affordable) the families of crew.
		Social Standing of Crew	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue-collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
		Proportion of Nonresident Employment	• **5**: 95–100% local • **4**: 70–95% local • **3**: 35–70% local • **2**: 5–35% local • **1**: Virtually no local crew	"Local" is defined as coming from, and spending their earnings within, the local fishing community. Nationals who are transient nonresidents, or considered outsiders in the fishing community, are not local.
		Crew Experience	• **5**: More than 10 years (skilled career crew) • **4**: 5–10 years • **3**: 3–5 years • **2**: 1–3 years • **1**: 0 full years of experience (mostly new crew each season)	Average years of experience of crew members.
		Age Structure of Harvesters	• **5**: All working ages are well represented • **4**: Slightly skewed toward younger or older • **3**: Skewed toward younger or older • **2**: Almost entirely younger or older, but working age • **1**: Harvesters primarily younger or older than working age	Age range of both captains and their crews.

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Post-Harvest Performance	Market Performance	Ex-Vessel Price versus Historic High	• **5**: Above 95% • **4**: 85–95% • **3**: 70–85% • **2**: 50–70% • **1**: Below 50%	The indicator is the ratio of annual ex-vessel prices to the average of the three highest annual ex-vessel prices in the past 10 years.
		Final Market Use	• **5**: Premium human consumption (premium quality and products) • **4**: High-value human consumption • **3**: Moderate-value human consumption • **2**: Low-value human consumption • **1**: Fish meal/animal feed/bait or nonconsumptive	Premium products are typically distinct to species, or species and source. Where a supply chain is diverse, score each weight by value.
		International Trade	• **5**: 90–100% export • **4**: 60–90% export • **3**: 30–60% export • **2**: 2–30% export • **1**: Virtually no export	Percentage of the fishery's value that is from fish exported to higher-value markets for consumption.
		Final Market Wealth	• **5**: Greater than US$35,000 • **4**: Greater than US$25,000 • **3**: Greater than US$12,500 • **2**: Greater than US$5,000 • **1**: Less than U.S.$5,000	Average per capita GDP of the consumer of a fishery's primary final product (pounds/kilos weighted by GDP). If multiple important products, weight by value.
		Wholesale Price Relative to Similar Products	• **5**: More than twice global average; • **4**: 120–200% of global average • **3**: Within 20% of global average • **2**: 50–80% of global average • **1**: Less than half global average	Ratio of average price for fish weight in wholesale (primary) fish product from the base country (converted to global currency), to a global average for similar species.
		Capacity of Firms to Export to the United States and the European Union	• **5**: Over 90% meet U.S. and EU health and labeling standards • **4**: 50–90% • **3**: Less than 50% • **2**: A small amount of product meets U.S./EU standards • **1**: Banned in the United States or European Union, or cost of compliance with U.S./EU standards is prohibitive	Percentage of a country's fish exports that meet U.S. or EU health and labeling standards. This is a country-level measure and refers to all processing capacity for export, including to regional markets.
		Ex-Vessel to Wholesale Marketing Margins	• **5**: More than 200% increase in value • **4**: 100–200% • **3**: 50–100% • **2**: 10–50% • **1**: Less than 10% increase in value	Increase in value of processed wholesale product from unprocessed ex-vessel product. [(Wholesale $/lb)*yield]/(ex vessel $/lb)
	Post-Harvest, Processing, and Support Industry Performance	Processing Yield	• **5**: At feasible frontier • **4**: Within 5% of the feasible frontier • **3**: Within 10% • **2**: Within 25% • **1**: Less than 75% of maximum yield	Ratio of actual processing yield (kilos/pounds) to the maximum processing yield technically achievable.
		Shrink	• **5**: Less than 5% • **4**: 5–10% • **3**: 10–25% • **2**: 25–50% • **1**: More than 50%	Loss of fishery product value due to handling, spoilage, and theft. This is very likely to be an estimate.
		Capacity Utilization Rate	• **5**: Virtually year-round • **4**: 75–95% of days • **3**: 50–75% • **2**: 20–50% • **1**: Less than 20%	Days open for processing each year. Such days would not normally include religious or civic holidays, or weekly rest days.

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Product Improvement	• **5**: 75–100% of landings are enhanced • **4**: 50–75% • **3**: 25–50% • **2**: 1–25% • **1**: No landings have enhancements	Proportion of harvest meat weight going into certified, branded, fresh premium, portioned, live, or value-added products.
		Sanitation	• **5**: Sanitation in landing and processing areas meets global health standards • **4**: Basic treatment, but falls short of global standards • **3**: Human waste is adequately handled, but fish waste presents sanitation issues • **2**: Functional toilets are available, but fish or fish handlers are exposed to untreated sewage • **1**: Functional toilets are not available in landing or processing areas	
		Regional Support Businesses	• **5**: All types of support are plentiful • **4**: Some types of support are capacity constrained or unavailable • **3**: Most types of support are capacity constrained or unavailable • **2**: Support limited to variable inputs • **1**: Industry support is not locally available	
	Post-Harvest Asset Performance	Borrowing Rate Relative to Risk-Free Rate	• **5**: Less than 1.75; cf. 30-year conforming mortgage • **4**: Less than 2.5; cf. personal bank loan • **3**: Less than 4; cf. good credit card rates • **2**: Less than 7; cf. bad credit card rates • **1**: Greater than 7; usury	Average ratio between the interest rate on loans made in the industry to risk-free rates over the last 3 years. If businesses can access the international credit markets, that is appropriate comparison; otherwise, use local risk-free rate.
		Source of Capital	• **5**: Unsecured business loans from banks/venture capital • **4**: Secured business loans from banks/public stock offering; investment from elsewhere in supply chain • **3**: Loans from banks secured by personal (not business) assets/government-subsidized private lending/government-run loan programs/international aid agencies; secured loans from elsewhere in supply chain • **2**: Microlending/family/community-based lending; loans from supply chain significantly reduce margins • **1**: Mafia/No capital available; exploitive relationship from elsewhere in supply chain	Points to be assigned based on the category of lenders or investors that is most typically used in the fishery. Second scoring method offered if the supply chain (e.g., processors, exporters) is primary source of capital.
		Age of Facilities	• **5**: First quarter of expected life; less than 7 years for a building • **4**: Second quarter of expected life; 7–15 years • **3**: Third quarter of expected life; 16–20 years • **2**: Fourth quarter of expected life; 21–25 years • **1**: Exceeding expected life; greater than 25 years	Average age of the key durable processing capital unit (plants, catcher-processor vessels).
	Processing Owners and Managers	Earnings Compared to National Average Earnings	• **5**: More than 50% above the regional average • **4**: Between 10 and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of annual earnings per resident owner/manager to the regional average earnings. This measure can include wealth accumulated to traders/middlemen if they represent an important part of the supply chain.

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Manager Wages Compared to Nonfishery Wages	• **5**: More than 50% above the regional average • **4**: Between 10 and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of resident owner/manager's average daily wage to average daily wage in their economic sphere (e.g., village if all economic activity is withing the village, but nation if participates in national markets as a consumer).
		Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic training is accessible • **1**: Formal education is not accessible	The level of education attained by (available and affordable) the families (i.e., children) of process owners/managers.
		Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	The level of health care accessible to (available and affordable) the families of processing owners and managers.
		Social Standing of Processing Managers	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue-collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
		Nonresident Ownership of Processing Capacity	• **5**: 91–100% local • **4**: 70–90% local • **3**: 35–70% local • **2**: 5–35% local • **1**: Virtually no local processing ownership	Proportion of ex-vessel value processed by regionally owned processing capital
	Processing Workers	Earnings Compared to National Average Earnings	• **5**: More than 50% above the regional average • **4**: Between 10% and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of annual earnings per worker to the regional average earnings.
		Worker Wages Compared to Nonfishery Wages	• **5**: More than 50% above the regional average • **4**: Between 10% and 50% above regional average • **3**: Within 10% above the regional average • **2**: Between 50% and 90% of the regional average • **1**: Less than half of the regional average	Ratio of worker's average daily wage to average daily wage in their economic sphere (e.g., village if all economic activity is within the village, but nation participates in national markets as a consumer).

TABLE B.1: FPIs Output Indicators Revision (Revision and Additions Are Highlighted) (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Social Standing of Processing Workers	• **5**: Among the most respected in the community, comparable with civic and religious leaders and professionals, such as doctors and lawyers • **4**: Comparable to management and white-collar jobs • **3**: Comparable to skilled labor jobs • **2**: Comparable to unskilled blue-collar or service jobs • **1**: Among the least respected, such as slaves or indentured servants	
		Education Access	• **5**: Higher education is accessible • **4**: High school–level education or advanced technical training is accessible • **3**: Middle school–level education or simple technical training is accessible • **2**: Basic literacy and arithmetic training is accessible • **1**: Formal education is not accessible	The level of education attained by (available and affordable) the families (i.e., children) of processing workers.
		Access to Health Care	• **5**: Global standard treatment for illness is accessible • **4**: Licensed doctors provide trauma, surgical, and drug treatments • **3**: Nurses or medical practitioners provide emergency and routine drug treatments • **2**: Basic and simple drug treatment is accessible • **1**: Medical or drug treatment is not accessible	The level of health care accessible to (available and affordable) the families of processing workers.
		Proportion of Nonresident Employment	• **5**: 91–100% local • **4**: 70–90% local • **3**: 35–70% local • **2**: 5–35% local • **1**: Virtually no local workers	"Local" is defined as coming from, and spending their earnings within, the local fishing community. Nationals who are transient nonresidents, or are considered outsiders in the fishing community, are not local.
		Worker Experience	• **5**: More than 10 years (skilled career crew) • **4**: 5–10 years • **3**: 3–5 years • **2**: 1–3 years • **1**: 0 full years of experience (mostly new crew each season)	Average years of experience of workers.

TABLE B.2: FPIs Input Indicators Revision

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Macro Factors	General Environmental Performance	Environmental Performance Index (EPI)	• **5**: EPI of 69–100 • **4**: 62–69 • **3**: 56–62 • **2**: 47–56 • **1**: 1–47	The EPI considers factors such as disease, water quality, air pollution, biodiversity, natural resources, and climate change. The EPI ranges from 1 to 100. Score is by 2010 EPI quintile.
	Exogenous Environmental Factors	Disease and Pathogens	• **5**: Harvest unaffected by disease • **4**: Harvest reduced by less than 10% • **3**: Harvest reduced by 10–30% • **2**: Harvest reduced by more than 30% • **1**: Harvest almost completely closed by shocks	Extent to which harvest value is affected by disease or pathogens, such as lobster shell disease or red tides.
		Natural Disasters and Catastrophes	• **5**: Harvest unaffected by disaster • **4**: Harvest reduced by less than 10% • **3**: Harvest reduced by 10–30% • **2**: Harvest reduced by more than 30% • **1**: Harvest almost completely closed by shocks	Extent to which harvest value is affected by factors such as earthquakes, volcanoes, hurricanes. Harvest can be affected through stock effects of damage to harvest capacity. Gradual effects of climate change (e.g., shifts in temperature or salinity) are not included here.
		Pollution Shocks and Accidents	• **5**: Harvest unaffected by shocks/piracy/pollution • **4**: Harvest reduced by less than 10% • **3**: Harvest reduced by 10–30% • **2**: Harvest reduced by more than 30% • **1**: Harvest almost completely closed by shocks	Extent to which harvest value in the reference year is affected by an episodic pollution event, such as an oil spill or piracy.
		Level of Chronic Pollution (Stock Effects)	• **5**: Not detectable • **4**: Minimal detectable levels • **3**: High levels detected • **2**: Pollution affects stock growth • **1**: Pollution leading to severe stock decline	Extent to which chronic pollution, such as from industrial or agricultural runoff, affects the stock.
		Level of Chronic Pollution (Consumption Effects)	• **5**: No consumption affected • **4**: Minimal consumption affects • **3**: Official consumption advisories • **2**: Temporarily ban harvest for consumption • **1**: Completely closed for consumption	Extent to which chronic pollution limits consumption.
	Country-Level Governance	Governance Quality	• **5**: Above 0.92 (highest-performing 2010 quintile) • **4**: 0.10 to 0.92 • **3**: –0.43 to 0.10 • **2**: –0.81 to –0.43 • **1**: Below –0.81 (lowest-performing 2010 quintile)	Average of four indicators in the World Bank's Governance Indicators, each scored [–2.5,2.5] • Government Effectiveness • Regulatory Quality • Rule of Law • Control of Corruption
		Governance Responsiveness	• **5**: Above 0.96 (highest-performing 2010 quintile) • **4**: 0.41 to 0.96 • **3**: –0.24 to 0.41 • **2**: –0.82 to –0.24 • **1**: Below –0.82 (lowest 2010 quintile)	Average of two indicators in the World Bank's Governance Indicators, each scored [–2.5,2.5] • Voice and Accountability • Political Stability
	Country-Level Economic Condition	Index of Economic Freedom	• **5**: EIF 69.2–100 • **4**: 62.5–69.1 • **3**: 57.1–62.4 • **2**: 50.5–57.0 • **1**: 1–50.5	Country's scone Heritage Foundation's Index of Economic Freedom. A detailed discussion of these factors and methodology is found in Miller and Holmes (2009). Scoring based on 2010 percentile.
		Gross Domestic Product (GDP) Per Capita	• **5**: Greater than US$30,000 • **4**: Greater than US$12,400 • **3**: Greater than US$6,000 • **2**: Greater than US$2,500 • **1**: Less than US$2,500	Dollars are 2010 US$.

TABLE B.2: FPIs Input Indicators Revision (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
Property Rights and Responsibility	Fishing Access Rights	Proportion of Harvest Managed Under Limited Access	• **5**: Virtually all • **4**: 70–95% • **3**: 35–70% • **2**: 5–35% • **1**: Virtually none	The proportion of total harvest that is under limited-access fishing regulation. This can include both regulatory and de facto access rights. Likely 1 if no permits issued, or permits issued without limits.
		Transferability Index	• **5**: Very Strong: Fully transferable through well-established, efficient market institutions • **4**: Strong: Fully transferable, but institutions are poor or illiquid • **3**: Moderate: Transferable, but with severe restrictions on who can hold, or how much • **2**: Weak: Transferable only under highly restricted and limited condition • **1**: Access rights not transferable	NA if no limited access.
		Security Index	• **5**: Very Strong: Access rights are completely respected and are not diluted (e.g., by issuing more access rights) by the government • **4**: Strong: Rights are mostly respected by the government; generally survive changes in government administration • **3**: Moderate: Rights are at risk of retraction or dilution with changes in administration • **2**: Weak: Rights are highly diluted or there is high political uncertainty • **1**: None: Access rights are not protected	Extent to which the government reduces or dilutes the access rights. Even if no limited access, can be scored to reflect the extent of other restrictions that limit erosion of access right (though probably low).
		Durability Index	• **5**: Very Strong: >10 years to perpetuity • **4**: Strong: 6 to 10 years • **3**: Moderate: 1 to 5 years • **2**: Weak: Seasonal • **1**: None: None/daily	Duration of the property right. Can be scored to reflect harvesters' expectations of continued access, even if access licenses/rights are given without limits.
		Flexibility Index	• **5**: Very Strong: All decisions on time of harvest, gear used, and handling practices are in the owner's control • **4**: Strong: Minimal restrictions on time of harvest and technology • **3**: Moderate: Modest restrictions on time of harvest and technology • **2**: Weak: Significant restrictions on time of harvest and technology • **1**: Time of harvest, gear used, and handling practices are not in the owner's control	Ability of right holders to be flexible in the timing and production technology employed. Low scores will reflect restrictions that force inefficiencies. Even without limited access, there may still be scorable restrictions (gear, seasons, areas) that limit access flexibility.
		Exclusivity Index	• **5**: Very Strong: All decisions and access to the property are controlled by the right's owner (rather than those without rights, competing resource users [like recreational or by-catch fisheries]) • **4**: Strong: Little intrusion on resource by those without rights • **3**: Moderate: Modest intrusion on resource by those without rights • **2**: Weak: Significant intrusion on resource by those without rights • **1**: None: Completely unrestricted open access, despite putative right	Ability of right holders to exclude those who do not have the right from affecting the resource or market. Can still be scored to capture extent of de facto intrusion if access is not limited.
	Harvest Rights	Proportion of Harvest Managed with Rights-Based Management	• **5**: Virtually all • **4**: 70–95% • **3**: 35–70% • **2**: 5–35% • **1**: Virtually none	The proportion of total harvest that is under rights-based fisheries management. Rights include those for some fixed quantity or fish (e.g., a quota), or a fixed share of landings in an area (e.g., a TURF gives 100% of landings in an area). Rights can be held by individuals or communities, and can include de facto and de jure rights. (Input rights, like trap tags, are strong access rights, but not harvest rights included in this section.)

TABLE B.2: FPIs Input Indicators Revision (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Transferability Index	• **5**: Very Strong: Fully transferable through well-established, efficient market institutions • **4**: Strong: Fully transferable, but institutions are poor or illiquid • **3**: Moderate: Transferable, but with severe restrictions on who can hold, or how much • **2**: Weak: Transferable only under highly restricted and limited condition • **1**: Access rights not transferable	Probably NA if there is no harvest right.
		Security Index	• **5**: Very Strong: Harvest rights are completely respected and are not diluted (e.g., by issuing more harvest rights) by the government • **4**: Strong: Rights are mostly respected by the government; generally survive changes in government administration • **3**: Moderate: Rights are at risk of retraction or dilution with changes in administration • **2**: Weak: Rights are highly diluted or there is high political uncertainty • **1**: None: Harvest rights are not protected	Extent to which the government reduces or dilutes the harvest rights. Probably NA if there is no harvest right.
		Durability Index	• **5**: Very Strong: >10 years to perpetuity • **4**: Strong: 6 to 10 years • **3**: Moderate: 1 to 5 years • **2**: Weak: Seasonal • **1**: None: None/daily	Duration of the harvest right. Probably NA if there is no harvest right.
		Flexibility Index	• **5**: Very Strong: All decisions on time of harvest, gear used, and handling practices are in the owner's control • **4**: Strong: Minimal restrictions on time of harvest and technology • **3**: Moderate: Modest restrictions on time of harvest and technology • **2**: Weak: Significant restrictions on time of harvest and technology • **1**: Time of harvest, gear used, and handling practices are not in the owner's control	Ability of right holders to be flexible in the timing and production technology employed. Probably NA if there is no harvest right.
		Exclusivity Index	• **5**: Very Strong: All decisions and access to the property are controlled by the right's owner (rather than those without rights, competing resource users [like recreational or by-catch fisheries]) • **4**: Strong: Little intrusion on resource by those without rights • **3**: Moderate: Modest intrusion on resource by those without rights • **2**: Weak: Significant intrusion on resource by those without rights • **1**: None: Completely unrestricted open access, despite putative right	Ability of right holders to exclude those who do not have the right from affecting the resource or market. Probably NA if there is no harvest right.
Comanagement	Collective Action	Proportion of Harvesters in Industry Organizations	• **5**: Virtually all • **4**: 70–95% • **3**: 35–70% • **2**: 5–35% • **1**: Virtually none	Proportion of harvest where the primary harvesters consider themselves to be members of organized associations.

TABLE B.2: FPIs Input Indicators Revision (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Harvester Organization Influence on Fishery Management and Access	• **5**: Harvesters effectively determine allocation of resources • **4**: Harvesters have significant influence in determining allocation • **3**: Harvesters are politically active, but not controlling • **2**: Social or informal monitoring participation and allocation • **1**: No active effort or capacity to influence management	Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on management and access to the fishery.
		Harvester Organization Influence on Business and Marketing	• **5**: Harvesting organizations cooperatively determine marketing and operational details • **4**: Extensive joint marketing • **3**: Large subgroups facilitating marketing; joint purchasing • **2**: Small subgroups cooperating in purchasing or operations • **1**: No active effort or capacity to influence business operations	Subjective measure of how much influence harvesting organizations have, either directly or through political collective action, on management and access to the fishery.
	Participation	Days in Stakeholder Meetings	• **5**: More than 24 days per year • **4**: 12–24 • **3**: 6–11 • **2**: 1–5 • **1**: None	Days in stakeholder meetings per year spent by a participant in the fishery who is active in management. Note these are days with meetings, not FTE days. Include meetings of councils with public participation.
		Industry Financial Support for Management	• **5**: Virtually all • **4**: 50–95% • **3**: 5–50% • **2**: 1–5% • **1**: None	Proportion of the fishery management budget paid for by the harvesting or processing sector.
	Community	Leadership	• **5**: Widely recognized individual leader, or small group of individual leaders, who provides vision for management and is able to attract stakeholders to that vision • **3**: Ex officio leadership stations that maintain management institutions, but are not currently providing strong vision • **1**: No recognized leader providing vision for range of fishery stakeholders	The fishing community has strong leadership capable of envisioning and implementing effective management (this role may be provided by processors). Bins 2 and 4 may be scored as midpoints between descriptions.
		Social Cohesion	• **5**: 6 points • **4**: 5 points • **3**: 3–4 points • **2**: 1–2 points • **1**: 0 points	The resource users are socially connected and interact regularly in fishing and nonfishing spheres. Score one point for each of the following: • Common locations for gathering and meeting on a regular basis for nonfishery business, culture, or commerce • Presence of shared social norms that facilitate transactional trust • Presence of shared public institutions (government, schools, markets) • Absence of differences in social status or caste that prevent interaction • Absence of religious differences and/or conflict • Absence of cultural, ethnic, or tribal differences that obstruct interaction
	Gender	Business Management Influence	• **5**: Business management dominated by women • **3**: Business management is balanced between men and women • **1**: Business management is dominated by men	Extent of women's influence (not just participation) in the management of harvesting and post-harvest businesses, including decision making, ownership, and financing. This will not typically include development project staff or other "outsiders."

TABLE B.2: FPIs Input Indicators Revision (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Resource Management Influence	• **5**: Resource management and allocation process is dominated by women • **3**: Resource management and allocation process is balanced between men and women • **1**: Resource management and allocation process is dominated by men	Extent of women's influence (not just participation) in the resource management and allocation process. Influential people can be members of the harvesting or post-harvest sectors, scientists, or community members who do not work in the fishing sector. This will not typically include development project staff or other "outsiders."
		Labor Participation in Harvest Sector	• **5**: 80%–100% are women • **4**: 60%–80% • **3**: 40–60% • **2**: 20–40% • **1**: Less than 20% are women	Proportion of women involved in the harvest sector labor pool, either as captains or crew.
		Labor Participation in Post-Harvest Sector	• **5**: 80%–100% are women • **4**: 60%–80% • **3**: 40–60% • **2**: 20–40% • **1**: Less than 20% are women	Proportion of women in the post-harvest sector labor pool, as buyers, sellers, managers, or workers.
Management	Management Inputs	Management Expenditure to Value of Harvest	• **5**: Less than 5% of ex-vessel value • **4**: 5–25% • **3**: 26–50% • **2**: 51–100% • **1**: More than the value of harvest	Government, industry, and aid agency expenditures on fishery management activities including research, enforcement, and management capacity development (but not infrastructure)
		Enforcement Capability	• **5**: Strong capacity to enforce regulations for entire coastline, both nearshore and offshore • **4**: Capacity to enforce regulations for nearshore, but limited offshore • **3**: Capacity of enforce nearshore in most of the ports, very limited capacity offshore • **2**: Capacity or enforce only in major ports, minimal effective capacity offshore • **1**: No capacity to enforce	Enforcement capacity includes that of the government or fishing organization, or any other group that can effectively enforce management.
		Management Jurisdiction	• **5**: Stock's life cycle within a single management jurisdiction, or multiple jurisdictions, has an effective, formal system for joint management throughout the range • **4**: Effective coordination institution facilitates joint management throughout the region of primary importance • **3**: There is a coordination structure, but it does not have binding authority • **2**: Informal institutions for coordinating management • **1**: Jurisdictions effectively manage the same stock independently	Extent to which the life cycle or range of a stock can be managed under a single coordinated plan, or through which ineffective management in one jurisdiction can undermine efforts in another.
		Level of Subsidies	• **5**: No subsidies • **4**: 1 subsidy category • **3**: 2 subsidy categories • **2**: 3 subsidy categories • **1**: 4 subsidy categories	Receive one point each for four key categories of "bad" subsidies: fuel subsidies, fish access payment subsidies; capital or capital loan subsidies; and price support (through inputs or direct payments)

TABLE B.2: FPIs Input Indicators Revision (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
	Data	Data Availability	• **5**: Annual (or other appropriate period) sampling for stock assessment, landings, and economic data available • **4**: Consistently collected and comprehensive landings and price data available • **3**: Limited reliable landings or price data available; data irregularly collected or based on large samples • **2**: Available data based on small samples, or missing data, significantly impedes making inferences needed for management • **1**: No data are centrally collected	
		Data Analysis	• **5**: Biological and economic data used in prospective analysis of management • **4**: Biological data dominate simple prospective analysis • **3**: Biological or economic data are used to track performance, retrospectively • **2**: Data are used inconsistently or irregularly • **1**: No data analysis conducted in management process	
	Management Methods	MPAs and Sanctuaries	• **5**: More than 25% • **4**: 10–25% • **3**: 5–10% • **2**:Less than 5% • **1**: None	Percentage of area used in species life cycle where fishing is closed or highly restricted. Include total area under rolling or seasonal closures.
		Spatial Management	• **5**: 75–100% • **4**: 50–75% • **3**: 25–50% • **2**:Less than 25% • **1**: None	Proportion of fishing ground managed through either direct control by TURF or designated community management regions, or through indirect control by limiting access points (launch or landing sites)
		Fishing Mortality Limits	• **5**: Hard TAC established against which nearly all fishing mortality is counted • **4**: Hard TAC established, but there are sources of unaccounted mortality totaling less than 10%; or TAC is adjusted from biological guideline to compensate for sources of greater unaccounted mortality • **3**: There is a guideline mortality level that is generally met; hard TAC exceeded 10–50% by unaccounted mortality • **2**: Frequently exceeded guideline; hard TAC exceeded by more than 50% • **1**: Fishery does not have an explicitly mortality target	Extent to which fishing mortality is an explicit element of management.
Post-Harvest	Markets and Market Institutions	Landings Pricing System	• **5**: Virtually all • **4**: 70–95% • **3**: 35–70% • **2**: 5–35% • **1**: Virtually none	Proportion of the harvest sold in a transparent daily competitive pricing mechanism, such as an auction or centralized ex-vessel to wholesale market wherein sellers interact with many buyers and prices are public information.
		Availability of Ex-Vessel Price and Quantity Information	• **5**: Complete, accurate price and quantity information available to market participants immediately • **4**: Reliable price and quantity information is available prior to the next market clearing • **3**: Price information is available but no timely quantity information • **2**: Price and quantity information are inaccurate, lagged, or available to only a few • **1**: No information available	Scores the ability of the market to provide timely information to harvesters to which they can react by changing what or when they land.

TABLE B.2: FPIs Input Indicators Revision (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Number of Buyers	• **5**: Highly competitive • **4**: 4–6 buyers • **3**: 2–3 competing buyers • **2**: A small number of coordinating buyers • **1**: There is one buyer	Typical number of buyers of ex-vessel product accessible to a seller in a given market. If there are many landing sites, this is the buyers per landing site. If harvesters are generally indentured to a single buyer through credit relationships, there is one buyer.
		Degree of Vertical Integration	• **5**: Virtually all • **4**: 70–95% • **3**: 35–70% • **2**: 5–35% • **1**: Virtually none	Proportion of harvest where the primary harvester and primary processor/distributor are the same firm. The role of vertical integration here is to ensure harvest and delivery of fish under a common management, increasing efficiency over asynchronous market transactions.
		Level of Tariffs	• **5**: Virtually none • **4**: 0.5–2.5% • **3**: 2.5–5% • **2**: 5–10% • **1**: Over 10%	Official tariff rates charged for exports or imports to consumption markets.
		Level of Nontariff Barriers	• **5**: Are not used to limit international trade • **4**: Have very limited impact on international trade • **3**: Act to impede some international trade • **2**: Act to impede a majority of potential international trade • **1**: Act to effectively impede a significant amount of international trade	Nontariff barriers include quantity restrictions (import quotas), regulatory restrictions, investment restrictions, customs restrictions, and direct government intervention.
	Infrastructure	International Shipping Service	• **5**: Ocean/Air shipping services are readily available at lower than average rates • **4**: Ocean/Air shipping services are readily available at average rates • **3**: Ocean/Air shipping services are readily available at higher than average rates • **2**: Ocean/Air shipping services are available but irregular • **1**: International shipping is not available at reasonable rates	The quality of the service available to access global high-value markets, such as the United States or European Union (regardless of whether product currently exported). Average of the two measures (one for ocean shipping and another one for air shipping) on the left.
		Road Quality Index	• **5**: High-quality paved roads and extensive highways • **4**: Primarily paved two-lane roads and moderate highway • **3**: Primarily paved two-lane roads and minimal highway • **2**: Paved two-lane roads and well-graded gravel roads • **1**: Poorly maintained gravel or dirt roads	Travel time-weighted average road quality between the fishery's primary port and the most practical export shipping port for exported product.
		Technology Adoption	• **5**: Cell phones/fish finders/computers/processing/production technology are readily available • **4**: Cell phones/fish finders, and so forth, are common, but some other technology is not always available • **3**: Cell phones/fish finders, and so forth, are common, but some other technology is difficult to obtain • **2**: Cell phones are common, but most other technology is prohibitive • **1**: Very little advanced technology is accessible for the industry	

TABLE B.2: FPIs Input Indicators Revision (*Continued*)

COMPONENT	DIMENSION	MEASURE	SCORE SYSTEM	ADDITIONAL EXPLANATION
		Extension Service	• **5**: Broad extension service with field offices and close linkage with research community • **4**: Extension service with moderate field coverage and adequate linkage with the research community • **3**: Extension service, but with weak links to the research community • **2**: Minimal, poorly supported extension service • **1**: No extension service	Degree to which government or NGOs help harvesters improve fishing techniques or management through extension activities.
		Reliability of Utilities/Electricity	• **5**: Reliable electrical grid provides power in sufficient quantity to prevent product loss • **4**: Processors rely on grid, but maintain backup generators • **3**: Supply chains rely on own generation capacity • **2**: Supply chain sometimes loses product due to condition or irregular fuel supply for generators • **1**: Reliable generators or fuel supply not available	
		Access to Ice and Refrigeration	• **5**: Ice is available in various forms and in sufficient capacity to support fresh icing of all fish that needs to be iced • **4**: Ice is available in various forms, but quantity limits prevent applying to entire catch throughout supply chain • **3**: Ice is available in limited form and quantity, and thus applied only to most valuable portions of catch • **2**: Ice is available but capacity constrained; ice often reused, or used through melting stage • **1**: Ice quantities are extremely limited	

Appendix C: MILESTONES OF FISHERY PERFORMANCE INDICATORS (FPIs)

C.1. CONCEPT WORKSHOP (FEBRUARY 10, 2010, LONDON)

- Summary: fisheries experts reviewed the concept and three initial case studies. Recommendations were made regarding the scope and content.
- Participant list:
  - James L. Anderson, University of Rhode Island
  - Christopher M. Anderson, University of Rhode Island
  - Mike Arbuckle, World Bank
  - Tim Bostock, DFID
  - Steve Cunningham, IDDRA
  - Aaron Hatcher, University of Portsmouth
  - Arthur Neiland, IDDRA
  - Stetson Tinkham, International Coalition of Fisheries Associations (ICFA)
  - James Wilen, Department of Agricultural and Resource Economics, UC Davis
  - Erin Priddle, DeFRA
  - Richard Parsons, DeFRA
  - Charlotte Tindall, MRAG/Indep
  - Pam Masons, DEFRA
  - Nigel Edwards, FDF
  - Frank Asche, University of Stavanger
  - Ragnar Tveteras, University of Stavanger
  - Mike Parker, Fishing business representative, Young's Bluecrest
  - Carl Christian Smidt, OECD, Fisheries economist
  - Heike Baumüller, Chatham House

C.2. APPLICATION WORKSHOP (MAY 11, 2011, HONOLULU)

- Summary: 12 fisheries economist reported 15 pilot case studies of FPIs, mostly in Western countries. Recommendations were made on the applicability, scoreability, weighting system, quality control, and so on.
- Participant list:
  - James L. Anderson, World Bank
  - Christopher M. Anderson, University of Rhode Island
  - Jingjie Chu, World Bank
  - Gunnar Knapp, University of Alaska
  - Gil Sylvia, Oregon State University
  - Sherry Larkin, University of Florida
  - Frank Asche, University of Stavanger
  - Atle Guttormsen, Norwegian University of Life Sciences
  - Matt Freeman, Louisiana State University
  - Ganesh Thapa, University of Rhode Island
  - Tim Ward, South Australian Research and Development Institute
  - Daniel Huppert, University of Washington
  - Eric Thunberg, National Oceanic and Atmospheric Administration

Appendix D: FPIs APPLICATION—OUTPUT RESULTS

COMPONENT	DIMENSION	MEASURE	INDONESIA BSC		PHILIPPINES BSC		ICELANDIC LOBSTER	
Ecologically Sustainable Fisheries	Fish Stock Health and Environmental Performance	Proportion of Harvest with a Third-Party Certification	1	1.8	1	1.3	5	4.8
		Fish Stock Sustainability Index (NMFS)	1		1		5	
		Percentage of Stocks Overfished	1		2		5	
		Nonlandings Mortality	4		1		4	
Harvest Sector Performance	Harvest Performance	Landings Level	2	1.7	1	2.7	5	5.0
		Excess Capacity	1		2		5	
		Season Length	2		5		5	
	Harvest Asset Performance	Ratio of Asset Value to Gross Earnings	1	3.2	1	3.2	5	4.2
		Total Revenue versus Historic High	3		2		5	
		Asset (Permit, Quota) Value versus Historic High	5		5		2	
		Borrowing Rate Relative to Risk-Free Rate	5		5		4	
		Source of Capital	2		2		5	
		Functionality of Harvest Capital	3		4		4	
	Risk Exposure	Annual Total Revenue Volatility	3	3.7	3	4.3	5	4.9
		Annual Landings Volatility	3		5		5	
		Intra-annual Landings Volatility	3		5		5	
		Annual Price Volatility	4		5		5	
		Intra-annual Price Volatility	4		5		5	
		Spatial Price Volatility	5		3		5	
		Contestability and Legal Challenges	4		4		4	
	Owners, Permit Holders, and Captains	Earnings Compared to National Average Earnings	5	4.0	2	2.8	4	4.5
		Fishery Wages Compared to Nonfishery Wages	5		1		4	
		Education Access	4		4		5	
		Access to Health Care	2		2		5	
		Social Standing of Boat Owners and Permit Holders	5		3		4	
		Proportion of Nonresident Employment	3		5		4	
	Crew	Earnings Compared to National Average Earnings	5	3.5	3	3.3	5	4.3
		Fishery Wages Compared to Nonfishery Wages	5		3		5	
		Education Access	2		2		5	
		Access to Health Care	2		2		5	
		Social Standing of Crew	2		2		3	
		Proportion of Nonresident Employment	3		5		3	
		Crew Experience	4		4		4	
		Age Structure of Harvesters	5		5		5	

COMPONENT	DIMENSION	MEASURE	INDONESIA BSC		PHILIPPINES BSC		ICELANDIC LOBSTER	
Post-Harvest Performance	Market Performance	Ex-Vessel Price versus Historic High	2	3.7	4	3.3	5	4.3
		Final Market Use	4		4		4	
		International Trade	5		3		5	
		Final Market Wealth	5		5		5	
		Wholesale Price Relative to Similar Products	4		2		3	
		Capacity of Firms to Export to the United States and European Union	5		4		5	
		Ex-Vessel to Wholesale Marketing Margins	1		1		4	
	Processing and Support Industry Performance	Yield of Processed Product	5	5.0	2	3.2	4	4.4
		Capacity Utilization Rate	5		3		4	
		Product Improvement	5		5		5	
		Regional Support Businesses	5		1		5	
		Time to Repair	5		5		5	
	Post-Harvest Asset Performance	Borrowing Rate Relative to Risk-Free Rate	4	3.3	5	4.0	4	4.2
		Source of Capital	2		2		4	
		Age of Facilities	4		5		4	
	Processing Owners and Managers	Earnings Compared to National Average Earnings	5	4.2	4	4.3	5	3.7
		Manager Wages Compared to Nonfishery Wages	3		3		4	
		Education Access	5		5		5	
		Access to Health Care	5		5		5	
		Social Standing of Processing Managers	3		4		4	
		Nonresident Ownership of Processing Capacity	4		5		3	
	Processing Workers	Earnings Compared to National Average Earnings	3	3.4	3	3.0	3	3.7
		Worker Wages Compared to Nonfishery Wages	3		3		4	
		Education Access	3		3		5	
		Access to Health Care	3		2		5	
		Social Standing of Processing Workers	3		3		2	
		Proportion of Nonresident Employment	5		4		3	
		Worker Experience	4		3		4	

Note: Scores below 2 are highlighted as they are within the warning zone, indicating immediate actions need to be taken with regard to those aspects.

Appendix E: FPIs APPLICATION—INPUT RESULTS

COMPONENT	DIMENSION	MEASURE	INDONESIA BSC		PHILIPPINES BSC		ICELANDIC LOBSTER	
Macro Factors	General Environmental Performance	Environmental Performance Index (EPI)	3	3.0	4	4.0	4	4.0
	Exogenous Environmental Factors	Disease and Pathogens	5	4.2	5	4.6	5	5.0
		Natural Disasters and Catastrophes	3		3		5	
		Pollution Shocks and Accidents	3		5		5	
		Level of Chronic Pollution (A)	5		5		5	
		Level of Chronic Pollution (B)	5		5		5	
	Governance	Governance Indicator—Effectiveness	2	2.0	3	2.5	5	5.0
		Governance Indicator—Voice and Accountability	2		2		5	
	Economic Condition	Index of Economic Freedom	3	2.5	3	2.0	4	4.5
		Gross Domestic Product (GDP) Per Capita	2		1		5	
Property Rights and Responsibility	Access	Proportion of Harvest Managed Under Limited Access	1	2.5	1	1.7	5	4.2
		Transferability Index	1		1		5	
		Security Index	4		1		3	
		Durability Index	3		1		3	
		Flexibility Index	3		5		5	
		Exclusivity Index	3		1		4	
	Harvest	Proportion of Harvest Managed with Rights-Based Management	1	2.7	1	1.7	5	4.0
		Transferability Index	1		1		5	
		Security Index	4		1		3	
		Durability Index	3		1		2	
		Flexibility Index	3		5		5	
		Exclusivity Index	4		1		4	
	Collective Action	Participation in Harvester Organizations	4	3.7	1	1.3	5	4.3
		Harvester Organization Influence on Fishery Management and Access	3		2		3	
		Harvester Organization Influence on Business and Marketing	4		1		5	
Management	Inputs	Management Expenditure to Value of Harvest	5	3.7	5	2.6	5	5.0
		Management Employees to Value of Harvest	n/a		1		5	
		Management Employees per Permit Holder	n/a		1		5	
		Research as a Proportion of Fisheries Management Budget	1		1		5	
		Level of Subsidies	5		5		5	

COMPONENT	DIMENSION	MEASURE	INDONESIA BSC		PHILIPPINES BSC		ICELANDIC LOBSTER	
	Data	Data Availability	3	2.5	1	1.5	5	5.0
		Data Analysis	2		2		5	
	Participation	Days in Stakeholder Meetings	3	1.5	2	1.5	2	3.0
		Industry Financial Support for Management	1		1		4	
Post-Harvest	Markets and Market Institutions	Landings Pricing System	4	3.2	1	2.3	2	3.5
		Availability of Ex-Vessel Price and Quantity Information	2		1		5	
		Number of Buyers	5		5		2	
		Degree of Vertical Integration	3		1		2	
		Level of Tariffs	1		1		5	
		Level of Nontariff Barriers	4		5		5	
	Infrastructure	International Shipping Service	4	3.5	3	2.3	4	4.7
		Road Quality Index	2		2		4	
		Technology Adoption	4		2		5	
		Extension Service	1		2		5	
		Reliability of Utilities/Electricity	5		2		5	
		Access to Ice and Refrigeration	5		3		5	

REFERENCES

AFTEN. 2011. Africa Program on Fisheries.

Anderson, J.L. 2002. "Aquaculture and the Future: Why Economists Should Care." *Marine Resource Economics* 17(2):133–151.

Anderson, J.L. 2007. "Sustainable Aquaculture: What Does It Mean and How Do We Get There?" *Species & System Selection for Sustainable Aquaculture*. PingSun Leung, Cheng-Sheng Lee, and Patricia J. O'Bryen, eds., pp. 9–17. Ames, IA, and Oxford, UK: Blackwell.

Anderson, J.L., and C.M. Anderson. 2010. "Fishery Performance Indicators." Final Report for ALLFISH.

Anggraeni, D. 2011. "Summary Report of Applying FPIs to Blue Swimming Crab Fishery in Indonesia."

Arnason, R. 2002. CEMARE Report 58. "A Review of International Experiences with ITQs-Annex to Future Options for UK Fish Quota Management." Retrieved from http://www.port.ac.uk/research/cemare/publications/pdffiles/reportspdf/filetodownload,103922,en.pdf.

BFAR. 2008. Philippines fisheries profile 2007. Bureau of Fisheries and Aquatic Resources (BFAR), Quezon City, Philippines.

Environmental Performance Index (EPI). 2011. http://epi.yale.edu.

Esty, D.C., C. Kim, T. Srebotnjak, M.A. Levy, A. de Sherbinin, and V. Mara. 2008. *2008 Environmental Performance Index*. New Haven, CT: Yale Center for Environmental Law and Policy and New York, NY: Columbia University.

Fishupdate, 2011. Retrieved on November 10, 2011, from http://www.fishupdate.com/news/fullstory.php/aid/16511/NFI_Crab_Council_Adopts_New_Sustainability_Policy.html.

Flores, J.O. 2005. "The Elasmobranch Fisheries in the SSME-Philippines: A Groundwork Study Towards Rational Policies for Conservation and Protection Management." Report submitted to World Wildlife Fund for Nature, Manila, Philippines.

Flores, J.O. 2011. "Summary Report of Applying FPIs to Blue Swimming Crab Fishery in the Philippines."

Food and Agriculture Organization (FAO). 2011. FishStat.

Ingles, J.A. 1996. "The Crab Fishery Off Bantayan, Cebu, Philippines." Institute of Marine Fisheries and Oceanology. p. 33.

Ingles, J.A. 2003. "Conservation of Fisheries: A Case Study of the Irrawady Dolphins in Malampaya Sound, Palawan, Philippines." Report submitted to Kabang Kalikasan ng Pilipinas, Manila, Philippines. p. 24.

Ingles, J.A. 2004. "Status of the Blue Crab Fisheries in the Philippines." pp. 47–52. In DA-BFAR (Department of Agriculture–Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. p. 378.

Ingles, J.A., and J.O. Flores. 2000. "Addressing Ecological Impacts of Fishing Gear: A Case Study for the Blue Crab Fishery of Guimaras and Visayan Sea." Presented at the 10th JSPS Fisheries Conference, Bogor, Indonesia.

Kaufman, D., A. Kraay, and M. Mastruzzi. 2008. *Governance Matter VII: Aggregate and Individual Governance Indicators 1996–2007*. Washington, DC: The World Bank.

Knapp, G. 2002. "Challenges and Strategies for the Alaska Salmon Industries." ISER, University of Alaska, Anchorage.

Marine Stewardship Council. 2009. http://www.msc.org/documents/msc-standards/MSC_environmental_standard_for_sustainable_fishing.pdf.

Miller, T., and K. Holmes. 2009. *2009 Index of Economic Freedom*. The Heritage Foundation/*Wall Street Journal* and retrieved from http://www.heritage.org/index/default.

MMAF (Ministry of Marine Affairs and Fisheries) and JICA (Japan International Cooperation Agency). 2009. Indonesian Fisheries Statistics Index 2009.

MRAG Americas. 2009. "Pre-Assessment of the Indonesian Blue Swimming Crab Fishery." Prepared for Sustainable Fisheries Partnership (SFP) and Asosiasi Pengelola Rajungan Indonesia (APRI).

National Fisheries Institute (NFI). 2011. Retrieved from http://www.aboutseafood.com/press/press-releases/nfi-crab-council-s-minimum-size-restrictions-begin.

NMFS. 2010. Trade Statistic Data.

NMFS. 2011. Trade Statistic Data.

PROFISH. 2011. "Strategic Vision for Fisheries and Aquaculture." http://siteresources.worldbank.org/EXTARD/Resources/336681-1224775570533/2011StrategicVision.pdf.

Romero, F.G. 2009. "Population Structure of the Blue Crabs, *Portunus pelagicus* (L.) in the Visayan Sea: Implications to Fisheries Management." Ph.D. Dissertation. University of the Philippines, Diliman, Philippines. p. 168.

SFP. 2010. "Indonesia Blue Swimming Crab Strategy for Fishery Improvement Partnership (Internal Strategy)."

SFP. 2012. "Indonesia Blue Swimming Crab Fishery Improvement Project (FIP)." Retrieved from http://www.sustainablefish.org/fisheries-improvement/crabs/indonesian-blue-swimming-crab on April 13, 2012.

Sulistiono, T. Nugroho and M. Zahid. 2009. "Ekobiologi dan Potensi Pengembangan Perikanan Rajungan Indonesia. (Eco-biology and Potential Development of Blue Swimming Crab Fishery in Indonesia)." Department of Fishery Resources Management. Faculty of Fisheries and Marine Sciences. Bogor Agricultural University.

The Economist. 2009. "Grabbing it All." January 3–9: 13–15.

The Fish Stock Sustainability Index. 2009. Retrieved from http://www.whitehouse.gov/omb/expectmore/detail/10000036.2007.html.

Transparency International. 2009. *Corruption Perceptions Index 2009*. Retrieved from http://www.transparency.org/.

The World Bank. 2004. "Saving Fish and Fishers: Toward Sustainable and Equitable Governance of the Global Fishing Sector. Agriculture and Rural Development." http://siteresources.worldbank.org/INTARD/Resources/SavingFishandFishers.pdf.

The World Bank. 2008. *The Sunken Billions: The Economic Justification for Fisheries Reform*. Agriculture and Rural Development. Washington, DC.

The World Bank. 2009a. *Doing Business 2010: Reforming through Difficult Times*. Palgrave Macmillan.

The World Bank. 2009b. *World Development Indicators*. Retrieved from http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,contentMDK:20535285~menuPK:1192694~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html.

The World Bank. 2011a. *Worldwide Governance Indicators*. Retrieved from http://info.worldbank.org/governance/wgi/sc_country.asp.

The World Bank. 2011b. *Worldwide Governance Indicators*. Retrieved from http://data.worldbank.org/indicator/NY.GDP.PCAP.CD.

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2. Mr. Lemuel Moscoso/Country Representative of Sigma International, Inc., Naga, Camarines Sur.
3. Mr. Jan van Klaveren/Owner of Janen International Corp., Escalante, Negros Occidental.
4. Mr. Mario Orchin Sr./Fisher in Cabusao, Camarines Sur.
5. Ms. Malta/Boat Owner in Tiglawigan, Negros Occidental.
6. Mr. Christopher Castro/Owner of JDLC Seafoods, Naga, Camarines Sur.
7. Mr. Gary Guevarra/Owner of A&G Seafoods, Tinambac, Camarines Sur.
8. Ms. Lene/Quality Control in a picking plant, Calabangga, Camarines Sur.

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