

# Guinea

## Evaluation of the Environmental, Economic and Social Performance of Artisanal Fisheries using the Fisheries Performance Indicators

December 2017

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## Introduction

While small-scale fisheries are critical to livelihoods and food security in West Africa, they are also particularly vulnerable due to insecure access and use rights. Customary practices for resource allocation and benefit sharing within coastal communities engaged in fishing have been frequently undermined by weak access rights leading to destructive competition with fellow fishers, and with other higher profile economic sector developments such as tourism, energy, mining, and deforestation of mangrove ecosystems. Industrial fishing fleets have historically been dominated by foreign vessels and limited enforcement capacity by national governments has led to a proliferation of illegal fishing. Simultaneously, the lack of local infrastructure has made product improvement unlikely and hindered the development of processing capacity. For fisheries to continue providing contributions to growth, nutrition, and livelihoods in developing countries, they must be managed so that exploitation is kept to within sustainable and optimal limits.

Improving governance of tenure, taking these aspects and underlying causes into consideration, is hence a matter of urgency. To address this issue, the West Africa Regional Fisheries Program (WARFP) began in 2009 as a mechanism to coordinate cross-country cooperation and targeted investments in fishery projects within West Africa. In 2015 Guinea was integrated into the program and is still engaged in the first round of funding. To understand the impact of WARFP investments across the region, a standardized metric of performance was desired. This metric should give a baseline for the state of national fisheries prior to investment, allow for cross-sectional comparisons across similarly scaled fisheries within the region, and importantly, allow national policy makers to observe the impact of their targeted investments over time.

### *Fishery Performance Indicators Methodology*

In support of this objective, the Fisheries Performance Indicators (FPIs) are being used to provide a quantitative perspective of fisheries performance across the WARFP fisheries. The FPIs are a rapid assessment instrument for measuring wealth generation from fishery resources. They were developed by James L. Anderson and Christopher M. Anderson under the guiding principle that a successful fishery management system is one that is ecologically sustainable, socially acceptable and generates sustainable resource rents or profits. The FPIs fall into two categories. The first category is outputs that identify and measure key factors that reflect success or failure in the attainment of the “triple bottom line” of environmental, social and economic sustainability. The second consists of input factors that enable or contribute to the process of meeting the “triple bottom line”.

The performance that the FPIs seek to quantify is the current level of success that the management systems are having in generating accurate, quantifiable, and understandable benefits for the environment, community, and economy. When implementing the FPIs, 121 individual measures are scored from 1 to 5 using bins that are designed to be easy to score across a wide range of fisheries and that are generally chosen to reflect the quintiles of performance on the metric globally. They rely on a basic set of data that should be available in all significant fisheries (e.g., volumes and prices) and expert assessment of qualitative indicator levels; they require no primary data collection unless existing datasets are incomplete. In addition, each measure is also given a quality score to indicate how confident the scorer is regarding the

accuracy of the chosen bin. Although individual metrics may be imprecise, using multiple metrics for each performance dimension leads to an accurate impression of what is and is not working. In this manner, the FPIs are robust to being employed in data poor fisheries and sectors.

The FPIs are designed not only as a tool for identifying fisheries that are underperforming in meeting the “triple bottom line”, but also as a framework for pinpointing what policies and interventions are likely to have the greatest impact. By analyzing relationships among the output sustainability and input measures, the FPI dataset can be used to understand the causes, correlations and paths toward successful industry development that can arise from investment in, and changes to, fishery policy and practice.

### *Artisanal and Industrial Fisheries of Guinea*

The artisanal fisheries of Guinea extend out to 12 nautical miles from the coastline and are particularly rich due to a coastal upwelling and the presence of several coastal estuaries. Small-scale fishing plays an important role in the socio-economic development of the country and is estimated to contribute 2.5 percent of GDP while employing 60,707 individuals (Recensement du parc piroguier de la pêche artisanale maritime, 2016). Only a small percent of landings is exported, but artisanal fisheries play a key role in food security with 40% of protein consumed in country coming from local fish (Ministère de la Pêche et de l'Aquaculture/Observatoire National de la Pêche, Projet FAO, 2016). Due to low levels of infrastructure and low barriers to access, the artisanal sector is prone to overexploitation and weak product improvement.

There is also a small industrial sector of roughly 34 boats, 3 of which are local (Liste des navires, Janvier 2017). These predominantly foreign boats are divided into three fleets based on whether they target demersal species and octopus, pelagic species, or shrimp. Since WARFP funding for Guinea is still in the initial stages, a decision was made to focus this analysis on artisanal and industrial fisheries more broadly instead of choosing specific ports where targeted investments are anticipated (as in Guinea Bissau). This decision was reinforced by the fact that industrial fishing is largely conducted by foreigners, very little of the product is landed in Guinea, and the main interaction that policy makers have with this sector is the setting of total allowable catch and the collection of license fees. The local experts felt that demonstrating the lack of transparency within the industrial sector would assist them with making the case for improvements in this sector and give a useful baseline of existing data collection efforts.

The goal of this report is to demonstrate that collecting data on the FPIs provided decision-makers in Guinea with valuable baseline data on the ecological, social and economic performance of their fisheries and also allowed for informative comparisons across sectors. In the long term, repeated collection of FPI data within these fisheries, and eventually at specific sites is an important component of evaluating and monitoring the World Bank’s investments in fisheries management and infrastructure.

The focus of this report is to explore commonalities and differences between the Guinean fisheries evaluated in 2016 and then to compare the average performance in Guinea with African fisheries in general, and with the entirety of the FPI database. The final sets of artisanal FPI scores examined in this report are from mixed species artisanal fisheries at the national level and within one specific location, Koukoude. Koukoude was chosen because it is a very representative artisanal port but has less post-harvest infrastructure than the average landing site and the local team anticipates WARFP investments in this location. For the most part, FPI scores for

Koukoude were very similar to the national artisanal scores so this report will only separate out this individual port when illuminating comparisons can be made.

In addition to the artisanal fisheries, scores for the industrial sector were also prepared. Although the management structure for all industrial boats is standardized, there are key differences in the post-harvest sector. Industrial vessels targeting pelagic stocks land and process most of their product in Guinea, while the demersal fleet lands most of their catch at sea and sends product directly for export without any value-added processing occurring in country. Although regulations require all industrial vessels to land at least 20% of their catch in Guinea, the lack of local processing capacity means that most demersal vessels targeting high value species prefer to pay fines for violating this restriction and continue their practice of direct export. For more detailed quantitative and qualitative insights into the nature of the three main fisheries selected, the reader should refer to the individual fishery profiles which are in Appendix A.

### **Description of Process and Data Quality**

In late June of 2016, Jennifer Meredith, the international FPI expert, traveled to Conakry to work with the local experts to conduct interviews and score the fisheries. The local team was composed of artisanal staff from the National Ministry of Fish and one of the team members will soon be an employee of WARFP. The members of the team were two senior members, Mohamed Soumah, and Mohamed Lamine Camara, and one junior member, Ibrahim Djenabou Camara. The team also worked in consultation with Guinea's national director of WARFP, Youssouf Camara, especially on the scoring of the industrial fisheries.

On the first day of work, the local team gave the international consultant an overview of the Guinean fisheries sector and the international consultant gave a presentation on the FPI methodology and examples of how the FPIs have been used in WARFP project evaluation in Liberia. Fishery choice was finalized on the second day and then the team proceeded through the FPI worksheet for the next three days, giving scores for the artisanal sector first and then for the industrial sector on the last day of work. For artisanal scoring, the team relied on raw data from the ministry of fish reports that were prepared in 2003, 2009, and 2016. . In addition, the ministry of fish collects price and landings data and has finalized these statistics for 2003-2013. Many of the other indicators only had data from the most recent round of surveys in 2016 because there have been recent advances in the survey methodology. The local experts were less familiar with the post-harvest sector and prior studies by the ministry had omitted this sector from surveys, so scoring for all post-harvest indicators relied on visiting the port in Conakry and the opinions of the local experts.

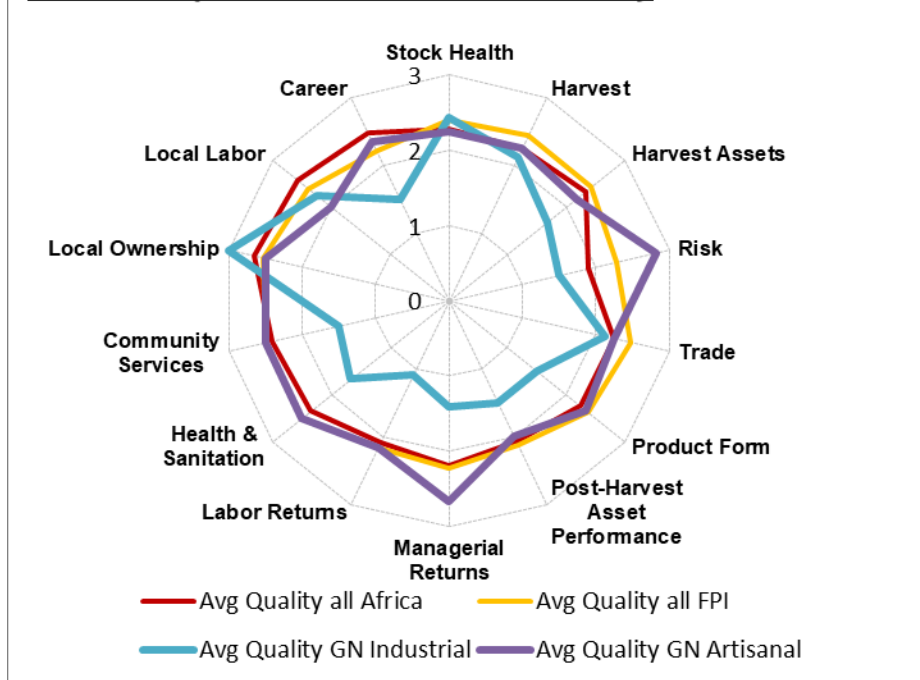
For the industrial fisheries, data collection efforts are minimal so the main resources were the national level fisheries management plan, the statistics on price and landings by species, a list of currently licensed industrial boats, and the best guesses of the local experts. While industrial pelagic landings occur in local ports, meaning that landings and prices are somewhat available, industrial demersal boats rarely land in country so there was very little data on even landings for this fishery. The national director of WARFP felt that despite these shortfalls in the available data, it was worthwhile to continue with FPI scores of the industrial fishery because these results would illumine these gaps in knowledge and demonstrate to the national government that much stricter disclosure standards are necessary in order to truly understand and manage the industrial fleet.

Guinea has an ongoing socio-economic data collection program. In 2016 surveys were conducted across artisanal landing sites on the revenues, methods, costs, and species targeted by artisanal fishers. Prior to that, the bulk of data collection efforts focused on price and landings data for each species at the national level and this data is available from 2003-2013. While this report was used to score the FPIs, it was also helpful that the local team had ready access to the raw survey and landings/pricing data so that when statistics outside of the report needed to be compiled, this could be done relatively quickly. One downfall of the existing studies is that they do not incorporate biological data and stock assessments for the artisanal sector are very rare so the managers rely on West Africa-wide stock assessments when setting the TAC (Total Allowable Catch) for the industrial sector. The final obstacle was that the existing socio-economic data collection system largely omitted the post-harvest sector except for asking about ex-vessel prices and method of processing. For this reason, our estimates of the well-being of women in the post-harvest sector were largely based on extrapolations from the opinions of local experts. While scoring the industrial sector, given its foreign ownership and limited contribution to the local economy, there is limited ongoing data collection on the operations of foreign vessels, especially with regards to the post-harvest sector.

The FPIs are designed to capture data quality so that managers can weight their findings based on the certainty of the scores. A data quality score of 1 means that the reviewer is 95 percent confident that the fishery should be in the bin assigned. Confidence can come from familiarity with the fishery, the reliability of another expert source, a calculation based on reliable data, or large ranges of the underlying metric for the given score that make another score highly unlikely for the fishery. Note that even when precise data is missing, the width of the 1-5 bins can still support a quality score of 1. Quality scores of 2 mean that the reviewer feels the score given is more likely than others, and the reviewer is highly confident (95%) that the true underlying metric would be within one of the given score. Finally, a quality score of 3 indicates that the reviewer is making an educated guess based on best available information, but is not highly confident the true metric would be within one of the given score.

Using the FPI database, we can examine how the quality of FPI scores in Guinea aligns with rest of the database, and Africa in particular. Figure 1 shows how the quality of output metrics range from 1 to 3. One of the strengths of the FPIs is that even in data poor fisheries, as is typical in Africa, the reviewer can be relatively certain in their score given because many of the bins for scoring are relatively large. In general, there is not a large gap in data quality between African fisheries and the rest of the database, except with regards to the risk and trade variables. The risk metrics rely on precise time series data on landings, prices, and revenue across landing sites. Trade variables require managers to know specific tariff rates and importantly, to have some knowledge of what happens in the final market where their fishery products are sold which can be difficult when exporters lack transparency.

## GN Comparison of Data Quality



*Figure 1: Comparison of Data Quality Scores for Guinea across all Output Metrics*

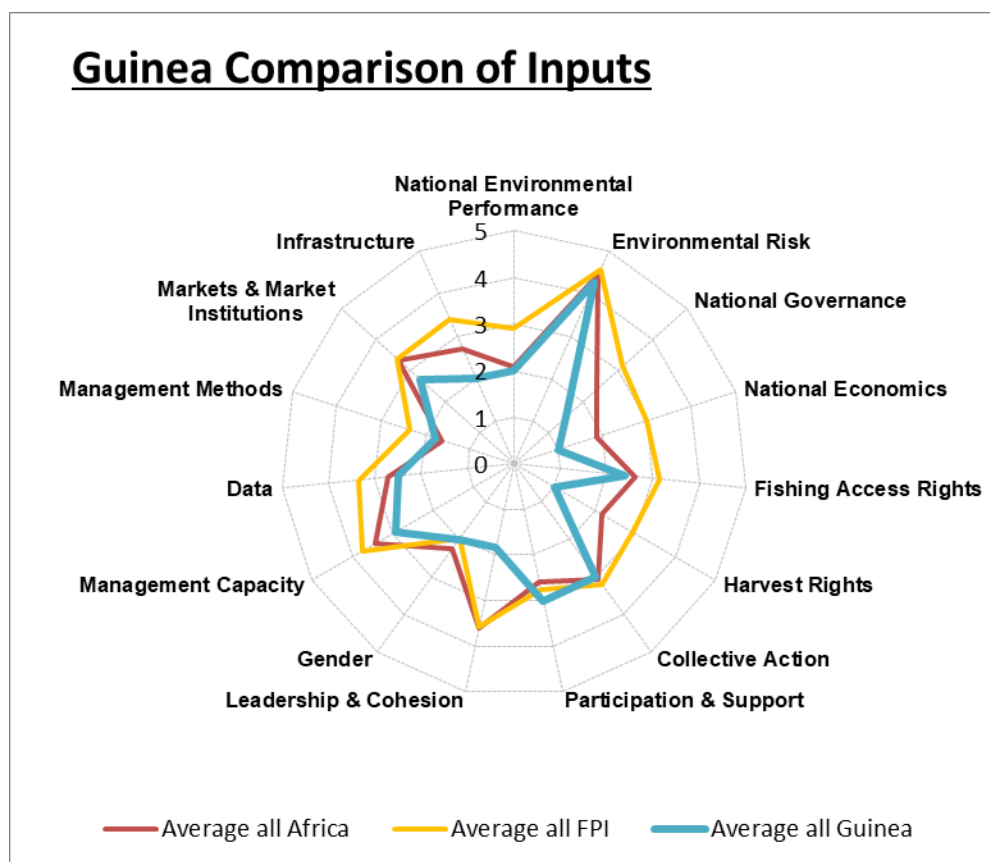
For most output indicators there is no gap in quality between Guinean artisanal fisheries and the rest of Africa and there are several instances where the managers are much more certain than average. The shortfall in the local labor dimension was driven by the fact that their surveys did not ask about the nationality of crew. Regular collection of landings and pricing data for the artisanal fleet led to a much higher quality score for managerial returns and risk dimensions since these variables rely on precise estimations of revenue over time, which is often based on short time series in other fisheries.

Within the industrial fishery there is a very clear gap in quality. The poor quality scores for harvest assets, risk, managerial and labor returns, career, and community services all reflect the fact that industrial participants are not currently required or willing to disclose their costs, methods of financing, profits, or the well-being of their crew and descendants. Conversely, the low quality scores in product form, post-harvest assets, health and sanitation, alongside the returns to the processing sector are driven by a lack of emphasis on the post-harvest sector in general and particularly by the fact that industrial demersal boats do not land product in Guinea. This lack of transparency meant that wholesale prices, product loss, processing capacity, and other post-harvest variables were entirely based on anecdotal evidence and conjecture. Overall, the attention to detail paid to assessing profits in the artisanal harvest sector and the long-running landings/price data collection effort is to be commended, but the data collection efforts would benefit from consistency and an increased emphasis on social and post-harvest components. It is evident that there needs to be a concerted effort to force industrial vessels to participate in surveys if any degree of certainty about the economic and social sustainability of their operations is desirable.

## Analysis of Results

### *Guinea compared to Global and African Averages*

To construct an average score for Guinea, the scores of each individual fishery were weighted by their percentage contribution to total revenue and compiled together. This score was then juxtaposed to the average score for African fisheries and the global average from the FPI database. Using the FPIs to score a fishery first allows us to compare the strategies of managers at the national and local level and Figure 2 shows how these inputs differ.



*Figure 2: Input Score Comparison for Guinean, African and Global Fisheries*

Since Guinea is one of the poorest nations in the world and also has a history of political instability, there is an obvious gap in the scores for national economics and national governance. Poverty and political unrest at the national level can be supposed to play a large role in making the governance of artisanal and industrial fisheries more difficult, especially in the capability and will to enforce regulations as is seen in the management capacity and methods dimensions. There is also a corresponding gap in infrastructure; compared to even the African average, roads are more likely to be unpaved, utilities are less reliable, and availability of ice and support services are more constrained. This lack of infrastructure helps explain why artisanal and industrial pelagic fisheries in Guinea focus on product preservation through smoking and salting rather than product improvement and value addition. Despite these challenges, data collection and utilization in Guinea is actually on par with the African average due to the regular collection of

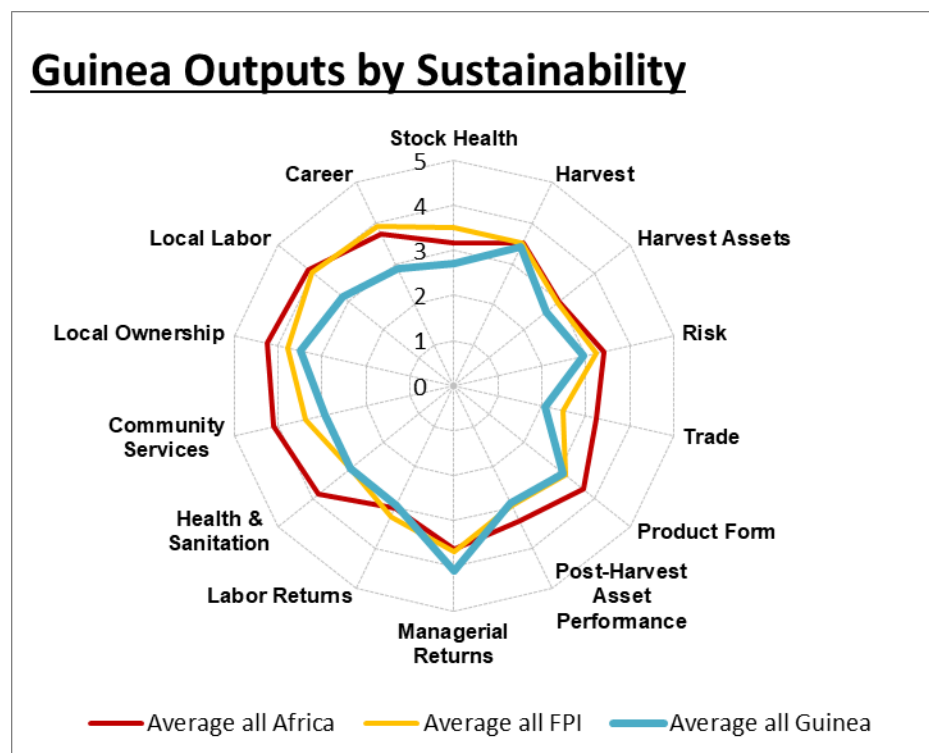


landings and pricing data and the utilization of biological data in setting TAC for the industrial fleet.

Interestingly, characteristics of the industrial fleet drove some distinct differences between Guinea and the rest of Africa. Because there is effectively no limit on the number of licenses given out, access right scores are slightly low. Since women are less likely to be involved in international industrial processing operations, the gender score is lower than it would otherwise be. Industrial harvesters are not integrated into Guinean society and lack a clear leadership vision capable of uniting their interest so the social cohesion and leadership dimension is much lower than in artisanal fleets across the continent. Industrial demersal landings are thought to be sold in less competitive markets with large international buyers and not in an auction framework or in a hyper competitive local marketplace; this drove the markets dimension score to be much lower than the African average.

The environmental inputs show consistency. The national environmental performance dimension is measured by the Environmental Performance Index, a score given by Yale researchers to the entire country. This dimension shows Guinea to be on par with its African neighbors, largely due to reduced mangrove deforestation being offset by health impacts from lack of clean water and sanitation. Conversely, the environmental risk dimension uses local measures of pollution and natural disasters and shows Guinea to be a high performer due to its relatively pristine coastline and the relative dearth of large scale industrial pollution. As environmental studies are conducted by WARFP staff, these ecological measures may converge since the FPI scores were largely based on anecdotal knowledge from the local experts and the sense that pollution is not a factor in local fisheries, especially in the consumption effects on local buyers.



Once we consider the inputs, or enabling factors, we also examine the resulting outputs in terms of ecological, economic, and social sustainability. Figure 3 demonstrates how Guinea aligns with global comparisons.



*Figure 3: Output Score Comparison for Guinean, African and Global Fisheries*

The largest gaps in performance for Guinea arose in the trade, community services, local labor, and career dimensions. Shortfalls in the trade sector are largely due to the lack of international commerce within the artisanal and industrial demersal fisheries, mainly arising due to a ban on fishery product imports from the EU and the infrastructure issues previously discussed. In addition, there is much less invested in product improvement than in other global fisheries since the local capacity to process high value fishery products does not exist and sanitary conditions remain poor. Low levels of community services occurring in this fishery were measured using only the opinions of local experts on access to education, contestability of management practices, and availability of support services. Since existing data collection efforts do not ask about the level of education accruing to participants and their descendants, these estimates could be biased or they could reflect the fact that education and supporting businesses are not accessible in the country due to poverty. Because Guineans do not have a longstanding tradition of maritime fishing, crew on boats in the artisanal and industrial fleets are much more likely to be foreigners than in other African countries. Low scores in the career dimension are driven by the lack of transparency from the industrial fleet. Little is known about the experience and age structure of their crew, which led the local experts to make conjectures that they are hiring mainly young and relatively inexperienced workers (based on eye witness observation), as is also the practice in the artisanal post-harvest sector where children are frequently employed.

Despite these challenges, managerial returns are higher in Guinea than the global average. This is because FPI returns scores are based on comparison to local earnings and alternative occupations. In Guinea, where there are few formal sector jobs and most fishery participants are also involved in agriculture, the main alternative is cash crop sugarcane or fruit farming. In comparison to agricultural returns, fishing often provides necessary liquidity and a better livelihood for those with the harvest capital to access the resource.

2016 Fishery	Species	Vessels and Gear	Characteristics	Management	Location and Nationality
<b>ARTISANAL FISHERY</b>  <b>28,114</b> <b>Harvesters</b>  <b>6,414</b> <b>Boat</b> <b>owners</b>  <b>25,420</b> <b>Processors</b>  <b>60,707</b> <b>total</b> <b>fishery</b> <b>employment</b>	<ul style="list-style-type: none"> <li>Small Pelagics (74%) Bonga Sardines</li> <li><i>Minor landings:</i> Barracuda Mullet</li> <li>Demersal (26%) Bobo croaker</li> <li><i>Minor landings:</i> Catfish Threadfish Shark</li> </ul>	<ul style="list-style-type: none"> <li>5468 small wooden planked boats</li> <li>1877 dugout canoes</li> <li>193 large wooden boats</li> <li>43% of all boats are motorized</li> <li>Gillnets</li> <li>Purse Seine</li> <li>Handline and Set Longlines</li> </ul>	<ul style="list-style-type: none"> <li>Year-round fishing but less in rainy season</li> <li>80% of vessels return daily</li> <li>63% of fish is sold fresh, 36% smoked and 1% salted.</li> <li>Less than 15% of landings go to export.</li> <li>Low levels of infrastructure. Less than 10% of landing sites have electricity, 20% have latrines, 9% have access to ice, and 10% have access to fuel.</li> </ul>	<ul style="list-style-type: none"> <li>Permits by type of net. No limit on the number of permits.</li> <li>Gear restrictions but corruption hinders enforcement.</li> <li>Two established protected zones.</li> <li>No formal co-management but strong harvester organizations.</li> <li>Intrusion and undocumented landings by Senegalese and industrial boats.</li> </ul>	<p>96% local boat owners 3% from Sierra Leone 70% local crew 30% crew other Africa</p>  <p>Credit: Wikipedia</p> <p>National-level scores with data from 234 landings sites within 6 prefectures: Boffa, Boke, Conakry, Coyah, Dubreka, and Forecariah</p>
<b>INDUSTRIAL PELAGIC FISHERY</b>  <b>Total</b> <b>Employment</b> <b>Unknown</b>	<ul style="list-style-type: none"> <li>Pelagics Sardines (59%) Chinchard (32%) Mackerel (10%)</li> <li><i>Minor landings:</i> Bonga Carangides</li> </ul>	<ul style="list-style-type: none"> <li>6 large trawl boats</li> <li>Purse Seines</li> <li>Gillnets</li> <li>Roughly 100 crew employed</li> </ul>	<ul style="list-style-type: none"> <li>Almost 100% of landings are frozen and landed in Guinea at 2 Kamsar or Conakry.</li> <li>Some transformation via smoking but all other processing occurs on board.</li> </ul>	<ul style="list-style-type: none"> <li>Licenses are collected and enforced.</li> <li>Two months of closure July-August</li> <li>Prohibited from fishing in artisanal zone (12 miles out).</li> </ul>	<p>Pelagic: 50% local boat owners 30% local crew</p>  <p>Credit: Wikipedia</p>
<b>INDUSTRIAL DEMERSAL FISHERY</b>  <b>Total</b> <b>Employment</b> <b>Unknown</b>	<ul style="list-style-type: none"> <li>Demersal Dorado (65%) Catfish (15%) Red mullet (20%)</li> <li>24 other stocks *Most boats also pursue octopus</li> </ul>	<ul style="list-style-type: none"> <li>28 large trawl boats with authorized mesh size of 70mm</li> <li>Roughly 250 crew employed</li> </ul>	<ul style="list-style-type: none"> <li>Mandatory to land 20% in Guinea but often pay fine and directly export to Asian market.</li> <li>Only juveniles are landed in Guinea.</li> <li>Very little data on post-harvest sector.</li> <li>Violations of no landing at sea ordinance.</li> </ul>	<ul style="list-style-type: none"> <li>Total allowable catch by sector.</li> <li>Limit on percent of catch rejected.</li> <li>Despite onboard observers, minimal power to enforce regulations especially when fish at night.</li> </ul>	<p>Demersal: 0% local ownership 10% local crew</p> <p>Overall Industrial: 3 Guinean boats, 29 Chinese boats, 2 Korean boats</p>

### Comparison across Guinean fisheries

As stated in the introduction, four fisheries were chosen for FPI scoring based on balancing the objectives of obtaining a representative national sample, anticipating future investment in the fisheries sector, and eliciting some variation in the existing context. The specific artisanal site of Koukoude was chosen because it is relatively representative of a low infrastructure artisanal landing site and WARFP staff anticipate making investments in the post-harvest sector at this location. Scores for Koukoude were so similar to the national artisanal scores that they are seldom broken out separately in the ensuing analysis, except when illustrative divergences occur.

For a full set of FPI scores for each fishery and for figures that show Koukoude alongside the national fisheries, please see Appendices C and D.

Other than Koukoude, all other scores were done at the national level to give a snapshot of the existing conditions in the artisanal and industrial fleets, prior to any large investments from WARFP. After recognizing that the post-harvest sector for industrial demersal and industrial pelagic is very different, with the vast majority of demersal landings going directly to export, the industrial scores were divided by species type. The table above illustrates the key characteristics of the artisanal and industrial fisheries and highlights their differences and similarities in terms of species harvested, vessels/gear employed, and management strategies in place. FPI input scores also allow us to demonstrate how local management and institutions may be influencing the performance of the individual fisheries. Figure 4 shows the FPI input scores for the three national-level fisheries.

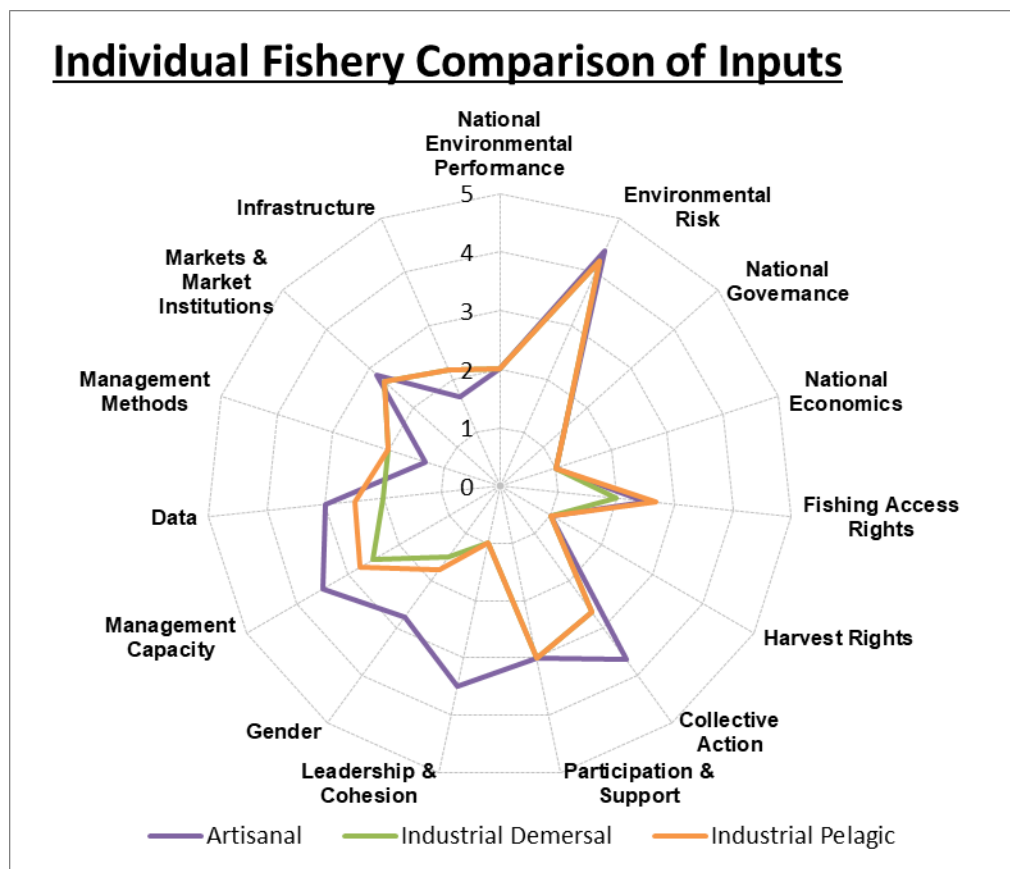
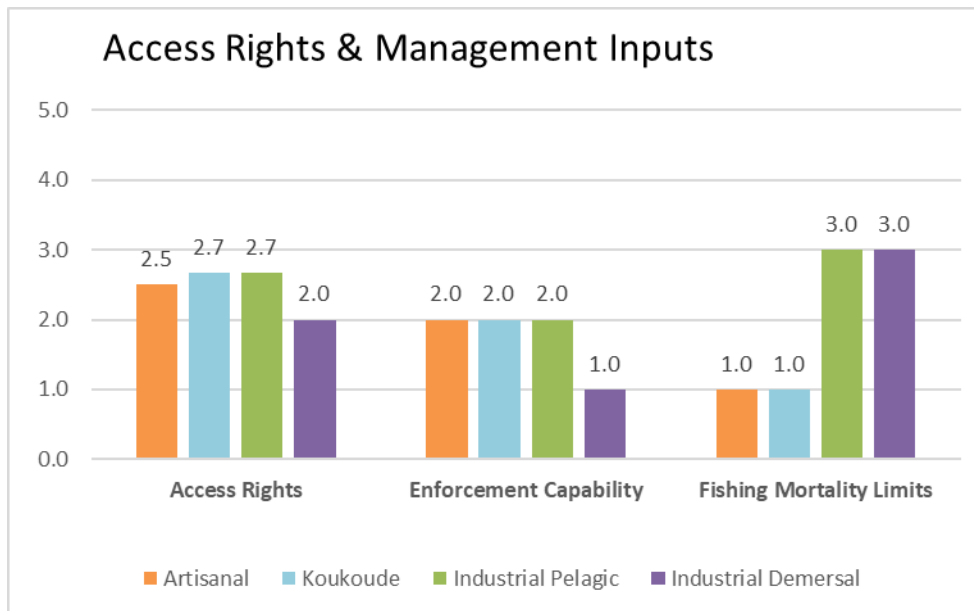


Figure 4: Input Score Comparison for all Sites

Nationwide government policy and environmental degradation are obviously consistent across fisheries, but there are interesting differences between the artisanal and industrial inputs in fishing access rights, collective action, leadership and social cohesion, management methods, markets and infrastructure. The management strategy for the industrial demersal and pelagic fisheries is largely identical, but some variance did arise in the gender, management capacity, and data input dimensions.

Property rights and the exclusivity of access are hypothesized to be a key driver of artisanal fisheries' success or failure. Scores in the fishing access rights and management input dimensions are highlighted in figure 5.

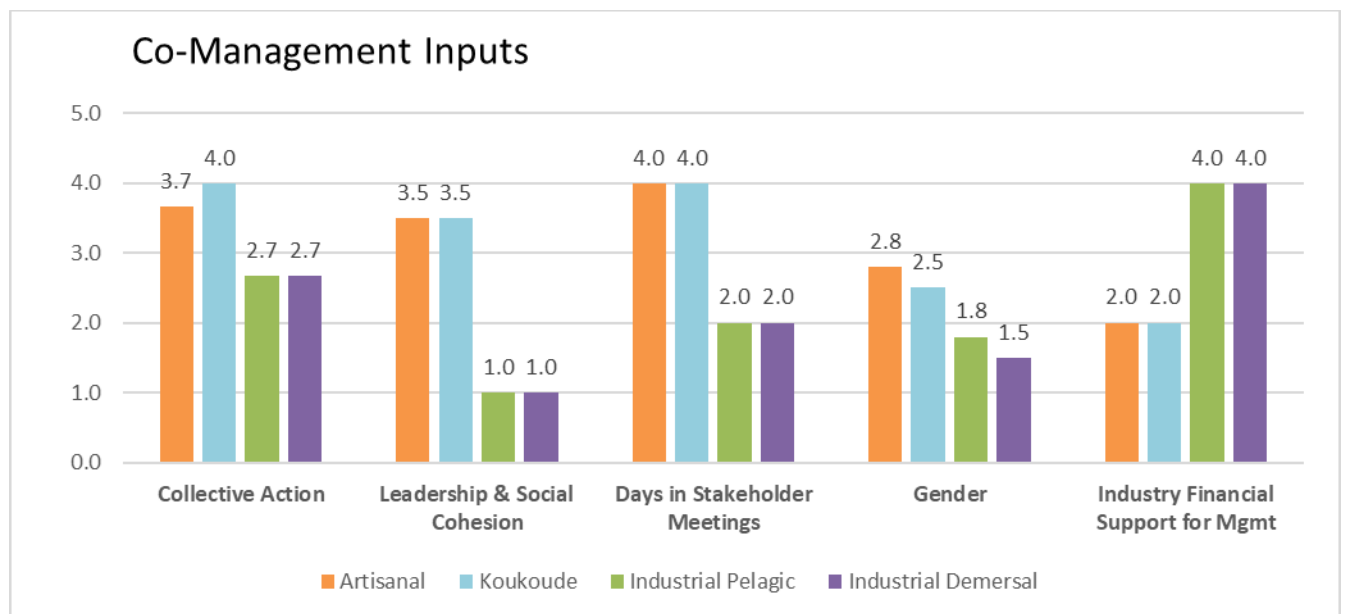


*Figure 5: Select Access Rights and Management Inputs for all fisheries*

In the artisanal fishery, it was estimated that 35-70% of landings are done legally with a license. The activity of dugout canoes (not required to obtain a license), intrusion by Senegalese fishers who illegally land their catch in other countries, and fishing done without license or using illegal methods such as monofilament nets lowered this percentage. In Koukoude, there is more monitoring and thus the access rights score is higher than the national average which is deflated by the number of rural sites without consistent enforcement. Across the artisanal fishery, users felt that although their access rights were not transferable, they were secure and durable, meaning they would survive any changes in administration and were renewable without danger of being revoked. Permits are purchased by net and each type of gear has a different net price (Guinea Fishery Management Plan, 2016). Artisanal harvesters can obtain permission to fish without any limit on the number of pounds landed or the number of boats permitted. Many foreign boats have permits for both Guinea and Guinea Bissau. There is also no limit on the number of artisanal licenses given to foreign boats from other West African countries, although their permit fees are higher. This means that the current exclusivity score for access rights is very low since the fishery is essentially open access with no limit on the amount of access rights distributed.

For the industrial fishery, there is TAC established separately for demersal and pelagic species and observers on board to enforce this limit, which is why the fishing mortality limits score is much higher than the artisanal fleet. In the industrial sector, permits are given by species type and not by gear. Industrial harvesters may receive infractions if they land one species type when they have a permit for the other. They are permitted to have bycatch only up to a given percentage of total landings (see Guinea Fishery Management Plan, 2016), but in practice no fees are levied unless the quantity is very large. The industrial pelagic fishery is more closely monitored than industrial demersal because all of the landings are done in local ports. Across Guinean fisheries, it was felt that in practice, they have a limited capacity to enforce gear type and TAC regulations only in major ports and not at all at sea where corruption means that surveillance is ineffective. Since the industrial demersal fleet lands most of their catch at sea there is effectively no capacity to enforce regulations and their enforcement capability score is lower than the other fisheries.

Access rights for the industrial pelagic fleet were relatively high since their onboard observers mean that every boat has a license and the fishery does not have a high degree overlap with illegal fishing. In the industrial demersal fishery there are many boats that come without licenses (perhaps only holding a license from a neighboring country) and many licensed boats that fish at night to avoid surveillance by onboard observers. There is so much illegal fishing that it was estimated that only 5-35% of total landings are done by licensed vessels under a limited access regime, within the bounds of the TAC, and without targeting juveniles. There is a limit on the number of industrial boats that are allowed, although historically it has seldom been binding, this made the industrial access rights score slightly more exclusive than in the artisanal sector. Across the industrial fishery, access rights are less secure and durable. Since the harvesters are largely foreigners, the access fees fluctuate annually and are much more likely to be revoked after infractions or with changes to the overall quota.



*Figure 6: Select Co-Management Inputs for all fisheries*

In addition to access rights and enforcement, the FPIs also show a difference in the fisheries' use of co-management, highlighted in figure 6. Within the artisanal fisheries, the collective action scores reflect that almost all harvesters are members of Confederation Nationale des Pecheurs de Guinee (CONAPEG). CONAPEG is the national-level fishing association that is regularly consulted by the ministry on management changes and is highly influential in negotiating license prices and enforcing monofilament regulations. In the post-harvest sector, the activities of CONAPEG are more constrained and harvesters negotiate their own individual prices rather than engaging in collective bargaining. Processors are also members of CONAPEG and the organization helps with the construction of smoking sites and sometimes intervenes with international purchasers of Bobo croaker. Because harvesters in Koukoude are even more organized than the average artisanal site, their collective action score is higher. In the industrial fishery, each harvesting company has a local representative and they sometimes band together informally to negotiate with the government. The harvesting companies tend to organize around nationality and despite their moderate levels of organization, they have less control over management practices because they are predominantly foreigners.

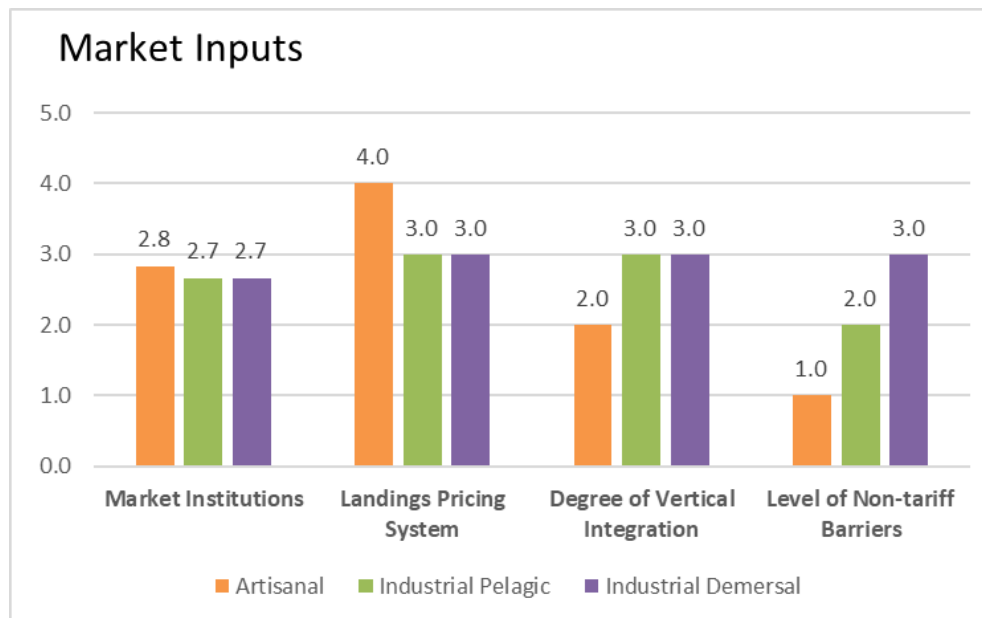
Elinor Ostrom and other socioeconomic researchers suggest that social norms and local leadership can facilitate trust and collaboration between fisheries participants that can lead to resource conservation even without formal management structures. Leadership and social cohesion scores in Figure 6 demonstrate that there is a large gap between the artisanal and industrial fisheries in the capacity for peaceable co-management. Artisanal participants are slightly more likely to have a strong local leader with vision for effective management, although a lack of respect for the national managers from Conakry means that even the artisanal leadership score is lower than the average FPI fishery. At artisanal ports, there is a common gathering space where participants from varied nationalities, social classes, and religions all coexist and exhibit trust and congeniality. In contrast, industrial harvesters are largely isolated on their individual vessels without social connections at common gathering locations or shared social norms and public institutions. In addition, they allow differences in nationality and religion to result in social divides. These characteristics lower the social cohesion scores of industrial fisheries.

Other management inputs exhibited in Figure 6 include days in stakeholder meetings and industry support for management. In the artisanal fishery, CONAPEG organizes national meetings three times a year for all participants and local port directors represent individual landing sites at monthly meetings. Individual processors also form informal groups and hold meetings weekly. In individual ports, CONAPEG also hosts local meetings once or twice a month. All of these artisanal characteristics increase their participation score whereas the minimal fees that the artisanal harvesters pay for licenses result in a lower score through a lack of industry financial support for management. In the industrial fishery, participants meet much less frequently, at most once per quarter to negotiate license fees with the government. In contrast, the licensing and research fees levied on the industrial sector make up the majority of the Ministry of Fish budget which moves the industrial participation input dimension score in the opposite direction. For the industrial pelagic and artisanal fisheries where landings are done in Guinea, monthly data on landings and prices are collected regularly but biological data is not available and managers rely on regional stock assessments from West African fisheries in general. The managers retrospectively use monthly data on landings to generate an annual statistical bulletin and make a management plan for the next year including a decision on the total quota for industrial harvesters. Data scores for the industrial demersal fleet are lower because the at sea landings mean that economic data on price and cost is not available.

Across the four fisheries, there are important differences in the involvement of women which are shown in the Gender dimension scores in Figure 6. These differences are attributable to the traditional post-harvest sector in West Africa being dominated by *maryeuses* (women who buy fish from harvesters and sell in the market) and *fumeuses* (women who smoke fish). Within the artisanal fishery, the harvest sector is almost all men and the post-harvest sector is almost all women. At Koukoude, the 2016 surveys revealed that 10% of processors are *fumeurs* (male smokers) so their gender involvement scores are slightly lower than the national average. Because women are also members of CONAPEG, and cultural norms mean that the *maryeuses* in particular have a strong voice in post-harvest issues, the gender scores for Guinean artisanal fisheries are above the African average. There is a history of violent protest by the *maryeuses*, who sometimes even lock the meeting room doors so the Minister of Fish cannot leave until he has heard their demands. These women sometimes use their credit relationships with harvesters to influence them not to land juveniles, but they are much more likely to limit their attention to post-harvest issues including financing.



The local experts have very little insight into what occurs in the post-harvest sector of the industrial demersal fishery, but speculated that women are much less likely to be involved in the processing of fish that is traded internationally since they only observe males onboard the foreign processing boats. While the majority of industrial pelagic fish are landed in Guinea, women have less influence on the management of this fishery since most decisions are made by the male-dominated staff of the Ministry of Fish.



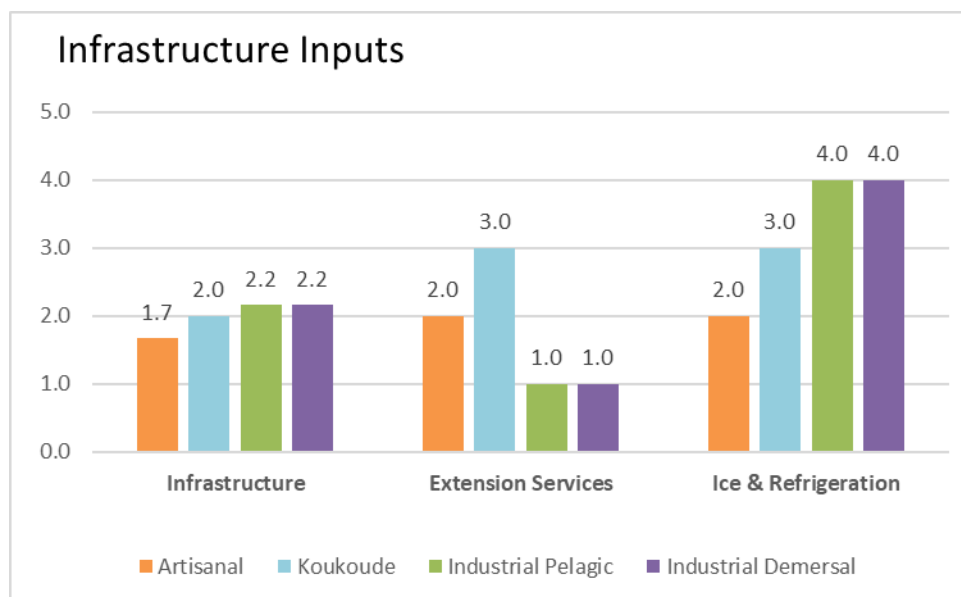
*Figure 7: Select Market Inputs for all fisheries*

Differences in access to markets and existing infrastructure will likely drive outcomes for both the harvest and post-harvest sectors. In the artisanal and industrial pelagic fisheries, the majority of harvesters do not sell their fish directly and instead sell it to a *maryeuse* (middlewoman) who may be their wife. The *maryeuses* compete but roughly 10% of the time the fishermen have a credit relationship with only one so they are obligated to sell to her. Disrupting competition comes from outsiders and occurs mainly in Conakry. Across the fisheries, prices are known for export species but not published for domestic markets and fishermen do not consider instantaneous data on price when deciding whether to fish.

Figure 7 shows some key distinguishing scores in markets and market institutions between the fisheries. The market institutions input dimension score for artisanal fisheries is slightly higher than industrial because fish are more likely to be landed under a transparent daily competitive pricing mechanism where there is a centralized ex-vessel to wholesale market with many buyers. Conversely, the artisanal score is lower in the vertical integration metric since very few harvesters process their own fish and only 4% of vessels are owned by *maryeuses*. There are some men who do their own smoking, but no data exists on the percent of landings that are treated in this way. While industrial boats are more likely to be directly owned by processors, they also sell largely in international markets which tend to be more concentrated. Guinean fish used to be exported to Europe but a 2007 ban on exports due to illegal fishing means that the large majority of international trade is impeded in the artisanal fishery and that industrial boats are restricted to Asian markets. The existing data for exportation by country and species is poor and while the local experts can guess that artisanal and industrial pelagic landings processed within Guinea are heavily impacted by the export ban, there is no concrete data to back this up because little is known about the level of exports prior to the ban. Some industrial pelagic



landings are traded within Africa, but the EU restrictions are more binding for this sector than for the industrial demersal boats, thus their level of non-tariff barriers metric is lower.



*Figure 8: Select Infrastructure Inputs for all fisheries*

Local infrastructure is a key determinant of processing capacity and product improvement. Within Guinea, all fisheries are more likely to ship product internationally via sea rather than by plane because air transport rates are very expensive. There are only two ports in Guinea that are capable of accommodating large vessels that could access high value markets. There are very few paved roads and most artisanal vessels do not have access to reliable utilities and electricity. Industrial vessels are constrained by the same road system and utilities grid, but they are more likely to have their own generators, although they still lose product due to power failures. The artisanal fleet is limited to the use of cell phone technology which is frequently used to communicate the location of fish, and the industrial vessels also have fish finders although the local experts are not aware of the use of any more sophisticated technology and modern processing facilities are certainly not available in country.

The increase in infrastructure scores in Koukoude is not due to physical infrastructure, but higher than average involvement of extension services whereby NGOs (Charent Maritime) and government officials help harvesters by introducing new techniques for harvest and smoking, promote mangrove protection, and conduct sensibility trainings. The industrial fishery is not served by extension services due to their illegal activity and foreign status there are very few formal or informal programs to interact with this sector. In Koukoude there are organizations who provide ice which is primarily used on the boat and in port and not throughout the supply chain. For most artisanal fishermen, ice is used only on Bobo croaker and other valuable demersal species while the rest of the fish is brought immediately to be smoked both because the quantity of fish is too large relative to the amount of ice available and because local consumers often prefer this method of processing. The industrial fishery ices or directly freezes the majority of their landings aboard the boat, but capacity constraints mean that this practice is inconsistent.

Just as the FPIs allow us to compare enabling inputs, figures 9 and 10 demonstrate how the fisheries compare across outcomes. The FPI outputs can either be organized into sectors (harvest and post-harvest) or sustainabilities (economic, and social) and figure 9 presents only the sustainability segmentation of dimension scores whereas figure 10 shows summary indicators for both methods. For more information on this facet of the methodology please refer to the FPI manual. For a presentation of the outputs by sector, see Appendix C.

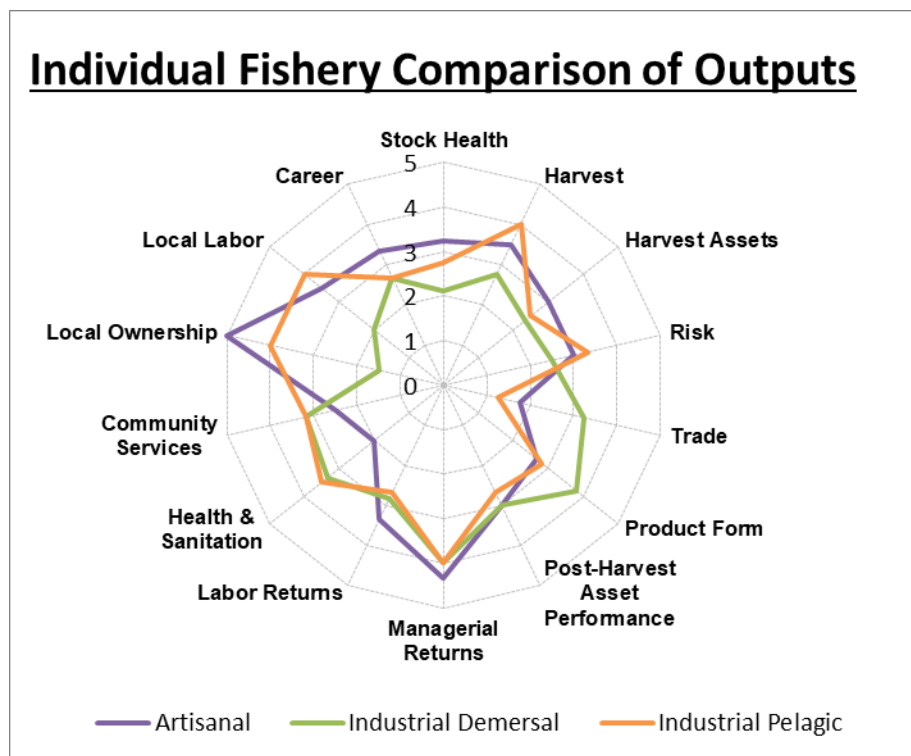


Figure 9: Sustainability Dimension Output Score Comparison for all fisheries

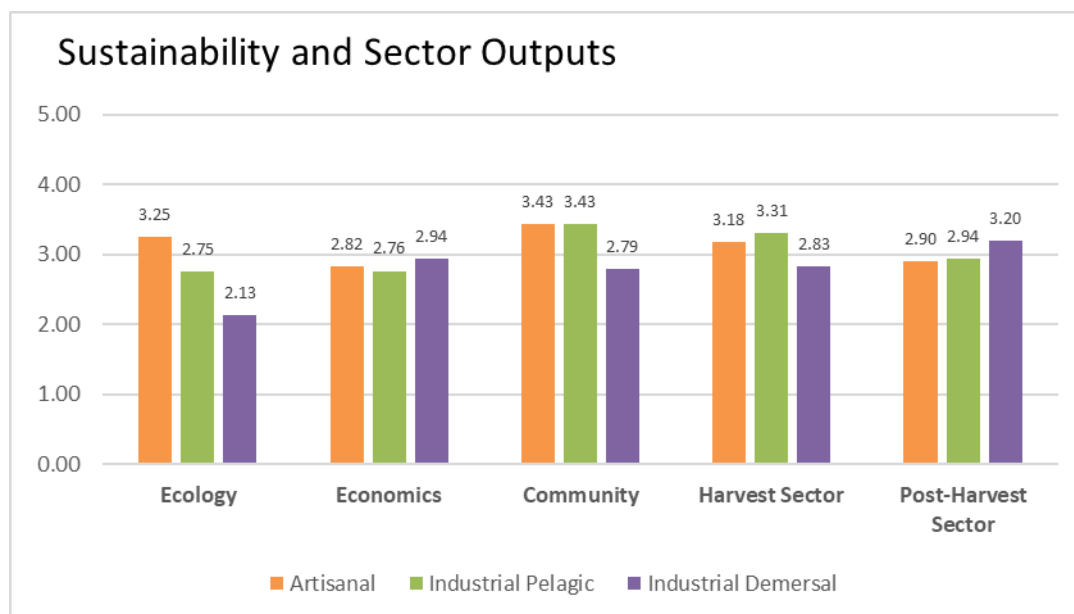
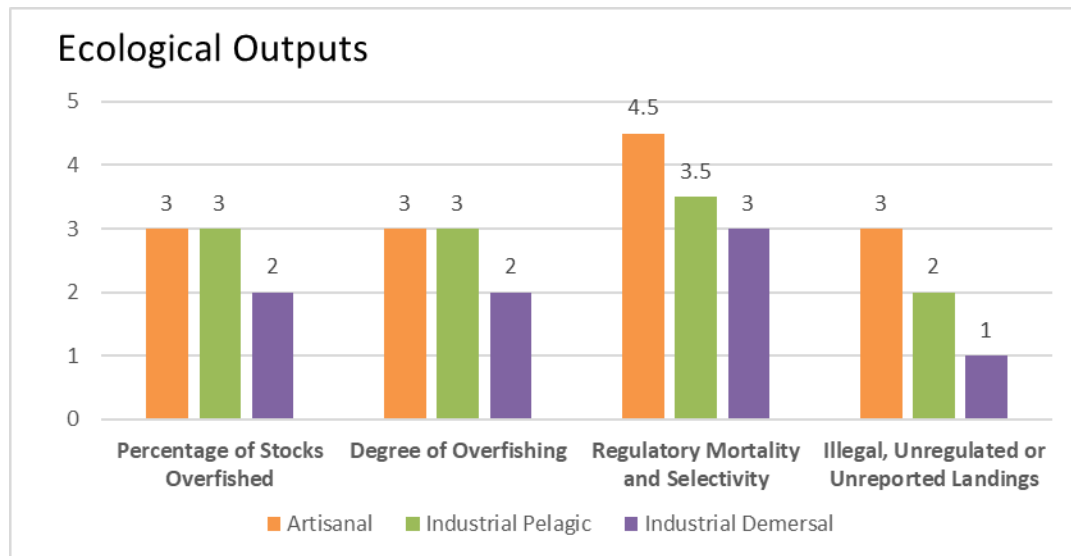


Figure 10: Aggregate Output Score Comparison for all fisheries

In the ecological/stock health dimension, the largest variation in scores was driven by the focus on over-exploited demersal stocks and encroachment by outsiders from Senegal. Figure 11

demonstrates the specific ecological outputs affected by these factors. The artisanal fleet focuses primarily on bonga, sardines, Bobo croaker, catfish, and mullet of which only Bobo and catfish are overexploited whereas the others are fully exploited and relatively stable. Industrial pelagic vessels also target chinchard, tuna, and carangides which are overexploited but a stock assessment in 2015 confirmed that for the majority of pelagic stocks, restrictions on overfishing have led to a recent stability in available biomass. In contrast, the industrial demersal fishery primarily targets dorado, catfish and red mullet among other high-value export species and the majority of these stocks are overfished with slight evidence that biomass is stabilizing.



*Figure 11: Select Ecological Output Score Comparison for all fisheries*

The artisanal fishery also receives higher ecological scores because the absence of TAC regulation and semi-selective gear means that regulatory discards and bycatch are minimal. Unlike the industrial fishery, artisanal harvesters are not required to buy licenses for a given species group so they tend to land anything they catch except prohibited marine mammals. Although there are no official bycatch estimates, the local experts had the sense that events such as the accidental capture of marine mammals are rare for the artisanal fleet. In the industrial fishery, the TAC regulation and licenses allocated by species group instead of gear mean that fish are thrown back for size and quantity limits. Legally, each industrial license has a corresponding cap on discards, and in practice there is some illegal bycatch but not more than 5% in the pelagic fleet and 5-25% in the demersal fleet. These estimates were based on onboard observer impressions and the fact that demersal vessels sometimes catch pelagic species while pelagic vessels are restricted to locations where demersal species are not present. Illegal fishing is much worse in the industrial fishery mainly because most activities are permitted in the artisanal fishery. Sometimes artisanal boats illegally catch fish in Guinean waters but land in Senegal or other West African countries, and it was estimated that this represents 5-25% of total artisanal landings. Industrial boats often seek to avoid the quota restrictions and laws that mandate fish be landed locally by fishing at night or transferring fish at sea. While no data exists on the frequency of these transgressions, local experts guessed that it represents at least 40% of total landings and is much more of a problem in the demersal fishery. All industrial harvesters are restricted to fish at least 12 miles from shore where there are few pollution issues, except

degradation of the ocean floor and reefs through trawling which particularly impacts the industrial demersal fishery.

The economic situation is the reverse of the ecological, with the industrial demersal fishery scoring slightly higher than the others. The majority of this variation is driven by post-harvest sector differences. Figure 12 shows some key differences in harvest sector economic outcomes. Across the fisheries, fishing is seasonal with less occurring during the rainy or season and also during the harvest season for the artisanal fleet. The landing level indicator reflects the economic efficiency of harvest levels and whether landings are strategically reduced in order to raise prices or promote the recovery of stocks. In the artisanal fishery, new entrants and lack of harvest limitations means that landings have been increasing each year and almost certain to be restricting stock recovery. Industrial pelagic landings are forcibly reduced through the TAC and the relative stability of pelagic stocks suggests that landings are close to MSY while the declining demersal stocks receive a lower score because harvest has been reduced to promote recovery.

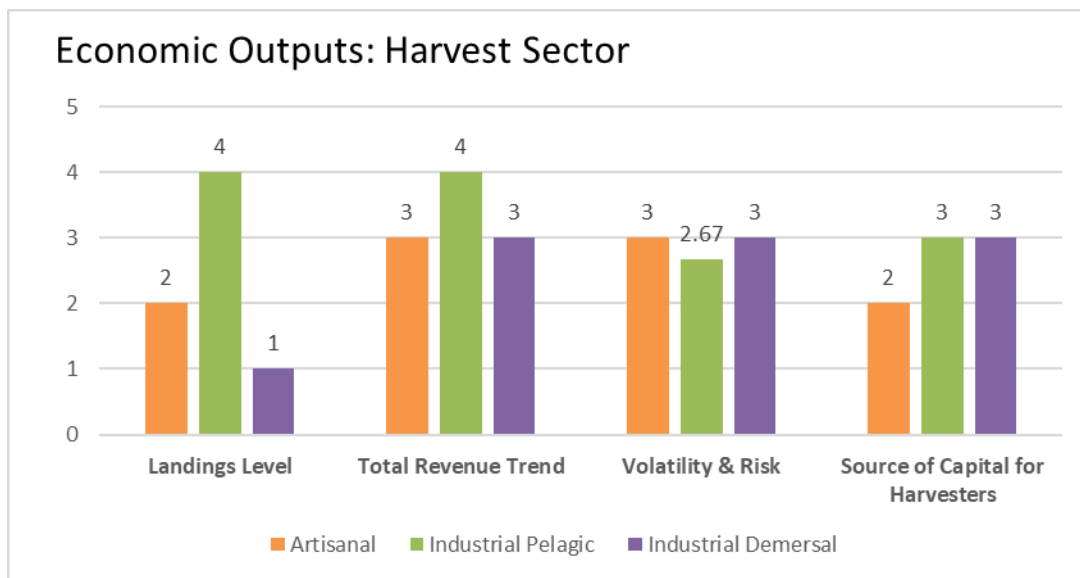


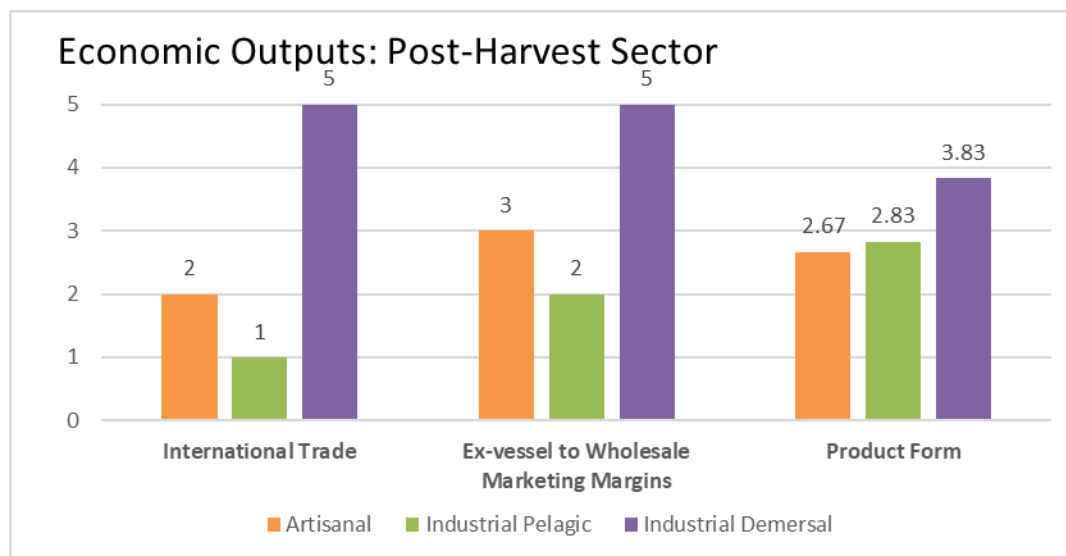
Figure 12: Select Economic Harvest Sector Output Score Comparison for all fisheries

Total revenue trends largely follow landings levels with harvesters targeting declining demersal stocks in the artisanal and industrial fisheries also experiencing lower revenue. In the absence of historical data on revenue, the scores were based on a perception that artisanal fishermen report declining revenue but have not chosen to exit the fishery. Industrial harvesters obstinately refuse to disclose their revenue, but observations suggest that they are doing slightly better than in the past, especially in the pelagic sector. Volatility as measured by the FPIs can come through unstable prices or landings and reflects economic well-being because instability can cause harvesters and processors to experience consumption shocks and to hesitate to make investments. For demersal species, prices are largely fixed by international trends which makes the artisanal and industrial demersal fisheries more stable. Prices for pelagic stocks fluctuate more over time based on inconsistent local demand and availability. Industrial prices and total revenue are also more stable because the bulk of product is landed at industrial ports where prices are more likely to be fixed and there is no spatial volatility in price. Total landings for the artisanal fleet are

highly stable since they will land whatever is available and are not restricted by species, they substitute towards whatever fish is present in greatest quantity.

Across the fisheries, artisanal harvesters are more credit constrained and often in debt to the post-harvest sector as a processor will finance their fishing trip in order to secure lower ex-vessel prices or a larger share of the catch. There is relatively low intervention by outside NGOs or the national government in the area of microcredit except in the post-harvest sector of some sites where many of the women are organized into credit cooperatives which allows them to furnish loans to the harvesters at lower interest rates. There are some harvesters who benefit from government run programs to help with boat loans, but the majority go to maryeuses in the post-harvest sector because banks and the government take too long. Industrial harvesters are more likely to have the personal collateral and familiarity with formal credit markets necessary to obtain bank loans, but local experts guess that they also pay high rates of interest comparable to a good credit card.

As stated, there are relatively large differences in the post-harvest sector across fisheries, some of which are highlighted in figure 13. Bobo croaker is the main export species in the artisanal fishery and roughly 20% of Bobo catch is exported. Guinean exports of Bobo from the artisanal fleet largely go to Japan, China, and Korea but it is unknown the exact percentages for each country. Because Koukoude does not have an international port, they are much less likely to export product and also have a lower composition of their catch from Bobo. In the industrial demersal fishery almost all of the product is sold outside Guinea. Despite laws that mandate 20% of the catch go to local markets to incentivize investment in local processing capacity, industrial demersal vessels prefer to pay the value of 20% of catch as a fine and land the product elsewhere where ex-vessel prices are much higher and processing plants meet international standards. Only juveniles with no value to international markets are landed illegally in Guinea. Conversely, industrial pelagic vessels target species for local consumption, land in Conakry only, and there is virtually no product improvement or export.

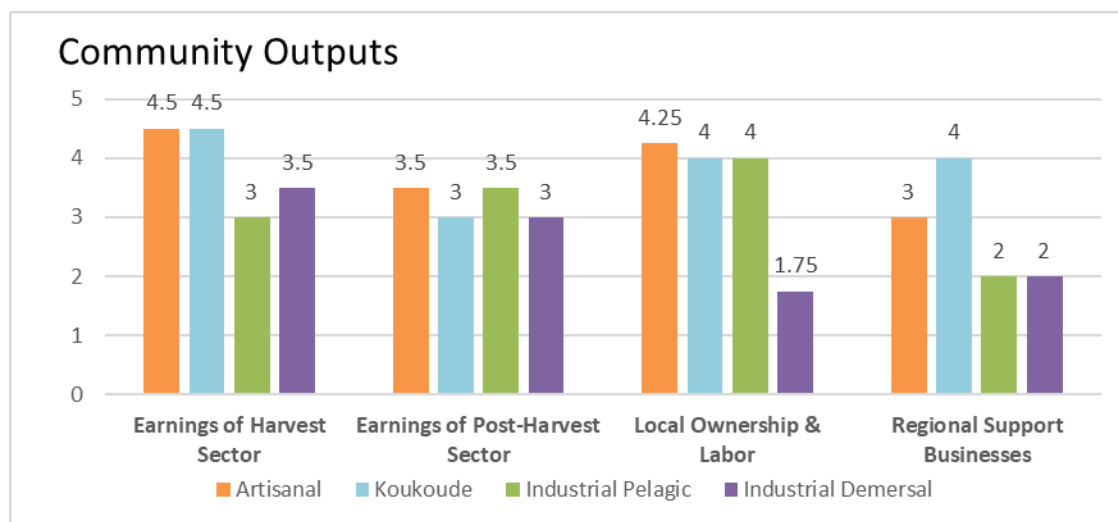


*Figure 13: Select Economic Post-Harvest Sector Output Score Comparison for all fisheries*

In both the artisanal and industrial pelagic fisheries, the post-harvest sector scores especially poor due to a lack of infrastructure and sanitation. The majority of artisanal landings are smoked as a preservation technique in the absence of ice or refrigeration and little product goes to higher value export markets since the majority of international trade is banned or too expensive to

access. For the artisanal fleet, Bobo croaker is an exception to this trend and sold fresh for fileting and marketing to Asian markets. In the industrial pelagic fleet, sardines, chinchard, and mackerel are sold fresh or frozen in cartons which leads to slightly higher product form score but the lack of export means that ex-vessel to wholesale marketing margins are very low and processed product only gains 10-50% of its value in wholesale markets. The prevailing focus on low-value human consumption products also leads to low ex-vessel to wholesale marketing margins in the artisanal fleet, but the impact of Bobo export means that the value weighted average is a 50-100% increase in prices from ex-vessel to wholesale. While the post-harvest operations of industrial demersal vessels are more opaque, local experts know that these high-value species are primarily processed at sea and sold fresh or frozen in filets once they reach Asian markets. This practice definitely increases product form scores and based on anecdotal evidence of observing Guinean dorado sales abroad, ex-vessel prices increase more than 200% once the product is processed.

The final category of outputs is community or social sustainability which incorporates the returns to labor and ownership, community services such as education, health and sanitation, and the percentage of participants who are local. Due to the preponderance of foreign participants, the community scores were much lower for the industrial demersal fishery than for the other two. Most of the community metrics were similar across fisheries with the exception of those shown in figure 14.



*Figure 14: Select Community Output Score Comparison for all fisheries*

Statistics on average earnings per artisanal boat captain and crew member were imputed by estimating the average daily landings per vessel, average annual prices, and normal share agreements between captains and crew that allocate double shares to the boat owner. Existing surveys ask about the daily earnings of fumeuses but not maryeuses or the assistants who help in the processing sector. This means that our estimates of post-harvest sector returns are much more uncertain and suggests that a value chain study for the artisanal sector would be helpful. The FPIs gauge the community sustainability of a fishery by examining how well off participants are relative to peers in their local community. Because artisanal participants are predominantly Guinean, they were compared to the national average wage and participants in the artisanal harvest sector are estimated to be doing very well compared to their peers. As stated, earnings of maryeuses are more uncertain due to a gap in existing data and the post-harvest sector employees are generally paid less since they are doing manual labor without as much prestige as harvest

crew. Post-harvest sector earnings for the artisanal sector are deflated for this reason and due to the absence of value-added export marketing, especially in low infrastructure ports such as Koukoude. Participants in the industrial fishery are much more likely to come from Asian countries where average incomes are higher and thus, their earnings relative to peers are lower while absolute earnings are conjectured to be higher. Across fisheries, it was generally felt that participants in the harvest and post-harvest sector have the social standing of skilled laborers except the post-harvest sector assistants who are viewed as unskilled labor and the industrial boat captains who have lots of conspicuous consumption and are treated like government managers.

Returns from fishing are also represented by access to education and healthcare. In a 2016 survey, 61% of artisanal harvesters reported sending their children to school. While residents of larger towns like Conakry with the proximity to higher education are more likely to see their children graduate from high school or even university, the average harvester can only afford to send their children to elementary school and they typically drop out to begin fishing at 10 or 12. For health services, 49% of respondents reported having access to health care but only 6% of ports have a clinic so the majority must travel long distances to obtain more sophisticated services and prohibitive travel costs mean that the average participant only has access to basic treatment and simple drug supplies. Crew and processing workers are even more likely than captains and processing owners to rely on what is available locally so their community services scores are slightly lower. Little is known about what is available to industrial harvesters, but the team guessed that their families in their country of origin are able to afford high school and surgical treatment because they can definitely afford to be treated for emergencies at the Conakry hospital.

Many policymakers prefer that fisheries returns accrue to local participants. The majority of the variation in social outcomes was driven by a difference in nationality across fisheries. The 2016 survey showed that 96% of artisanal captains are Guinean and while it did not ask the nationality of crew, guesses suggest that because the local seafaring tradition is relatively recent compared to other African cultures, the crew is roughly 70% Guinean. Koukoude is closer to Senegal than the average Guinean port so they have more foreign ownership of harvesting operations. All post-harvest managers and owners are locals whereas 5-30% of processing workers are from Sierra Leone or Senegal and came to go fishing, but when they cannot find a captain they will earn piece rate from helping at a smoking center or in the transport of processed fish. The post-harvest sector is similar in the industrial pelagic fishery, but only 50% of the 6 boat owners are Guinean and they tend to hire crew of the same nationality so the total harvest sector participation by locals is only 35-70%. Distinct from the other fisheries, the industrial pelagic fishery has no Guinean captains or processing owners, roughly 10% Guinean crew, and only the 20% of mandated landings are handled by locals.

There is another difference in community services driven by the economic spillovers from the fishery to other sectors. In Koukoude, there are mechanics and business selling ice but in the average artisanal site most types of support are capacity-constrained or unavailable so that harvesters must travel to Senegal or Conakry to acquire these items. The industrial fisheries contribute even less to local economies because the harvest and post-harvest sector only purchase food and fuel locally and buy all other inputs such as nets, maintenance, and other gear outside the country

## Conclusion

This initial implementation of the FPI methodology in Guinea suggested that key differences in management capacity, social cohesion, and collective action can drive ecological outcomes. Simultaneously, vast differences in the post-harvest sector's economic success and the fisheries' wealth-generation for local participants are also created. Reapplication of the FPIs in these fisheries throughout the duration of WARFP activities in the country will yield insight into the true causal connections between the sustainability of fisheries and management changes. The addition of specific sites to the Guinea FPI database will also allow managers to explore connections between targeted investments and ecological, economic, and social outcomes.

### *Domestic Capacity for Implementation*

Although the scoring of four fisheries was ambitious and beyond the scope of the initial proposal, the completion of 2016 scores in 3 days demonstrates that employing the FPIs as a monitoring tool is eminently feasible. The domestic capacity for implementing this tool is hampered by a few key elements: lack of data collection from the industrial and post-harvest sectors, inaccessibility of raw data, and language barriers between the FPI designers and the local staff.

Since the majority of the four local staff engaged for the project were formally under the employ of the national ministry and not WARFP, there is some concern that their incentives are not fully aligned with continued engagement with the FPIs or that there may be turnover in staffing that leads to the necessity for retraining. While the international FPI expert endeavored to explain the value of the tool and every step necessary for its implementation, there was a sense that the team was not fully convinced of its necessity nor did they understand the role that FPI scores will play in the future assessment of project outcomes. The situation in Guinea was slightly improved because the national director for WARFP was sometimes able to participate in meetings and there were plans to formally incorporate one other member of the team into WARFP staff eventually. Although the FPIs are designed to be a rapid assessment instrument, domestic capacity for implementation still depends on local buy in and having at least one local team member who can consistently ensure that existing data collection methods are altered to incorporate FPI metrics and is dedicated to tracking these metrics over time.

While the local experts employed did have access to raw historical data on prices and landings, it was not clear whether they also had raw data from the artisanal sector survey since they were primarily relying on the prepared 2016 report. The local experts were very helpful and even provided follow up statistics requested via email, but they were still fundamentally unwilling to share the raw data with the international expert or World Bank staff. This situation is both inefficient and unsustainable in the long run. While local input is certainly key to preparing FPI scores, sharing data across the team would facilitate more timely preparation of reports, more rigorous robustness checks, and allow the international expert to help streamline the FPI data collection and score preparation process based on existing local databases.

Even if the local team had been willing to share existing data in its entirety, there would still have been gaps in our knowledge. Within the artisanal fishery, little effort has been made to engage the post-harvest sector in data collection efforts. There are some survey questions for processors, but there is no existing value chain study that can help estimate the earnings of middle women or employees in the post-harvest sector. Hopefully the primary data collection tool that was designed in French by the local and international experts in Guinea Bissau (see



Appendix B) will help with future changes to Guinean survey methodology and facilitate more robust scores in the future. In the industrial fishery, the revenue, costs, and other activities of both harvest and post-harvest participants (particularly for industrial demersal) are completely opaque to policymakers and it seems that the national government does not have the power to force industrial vessels to disclose this data. If WARFP plans to make real changes to the operations of these industrial fisheries, it would be advisable to make data disclosure a key part of the agenda because at the moment foreign vessels are profiting from their access to Guinean fisheries without any transparency or reciprocating investment in local capacity.

All FPI materials including the score sheet and manual were originally prepared in English and since the working language for this mission was French, the international expert eventually translated the scoresheet to French and incorporated links to a newly designed primary data collection tool. If the language barriers had been more fully understood and this had been fully completed prior to arrival in country, there is a chance that primary data collection for 2016 could have been completed and that the mission in general would have gone smoother. Translation of the FPI manual into French should also be a priority for future work since it provides valuable examples and practical scoring guidance not present in the worksheet.


Once the training was completed and the primary data collection tool was compiled, the local team and the international expert were seldom in contact so it is difficult to say whether the capacity for local execution of scores exists. If the local experts are able to translate the results of future field surveys into FPI scores with assistance via email from the local expert then this would be a very sustainable model for FPI capacity building, but this remains to be seen. If such a model cannot function but the designed FPI survey is conducted annually or biannually and the resulting raw data is handed over to the international expert, then this approach could function as well.

### *Suggestions for Future Research*

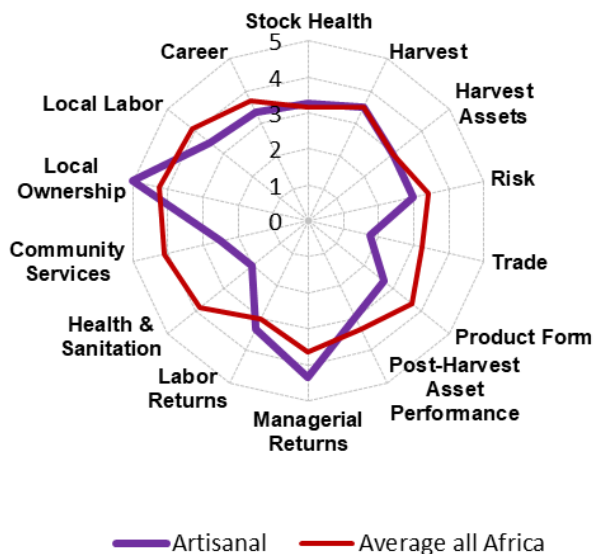
The focus on national-level artisanal fisheries left open many questions about how the operations at specific ports in Guinea depend on management interventions and existing norms. Another round of scoring using primary data collected in individual artisanal ports would be advisable, especially in the three sites that WARFP has selected for investment in co-management. National 2016 artisanal FPI scores can be used as a baseline, but an even more robust measure of return on investment would be to implement the FPIs in specific ports before and after changes are made. A value chain study of Guinean fisheries would yield valuable background information on the operations of the post-harvest sector and insight into the returns of participants, value-added from processing, and exact volume of international trade. While industrial vessels were separated into pelagic and demersal, there are other industrial boats that target tuna and shrimp who were not included in the analysis due to time constraints and missing data on the industrial post-harvest sector. If obtaining data from the industrial sector proves to be intractable, an ideal future use of the FPIs in the Guinean fisheries would be to identify sites that are likely to have investment in infrastructure, co-management, or enforcement and conduct pre and post scores to evaluate the efficacy of such changes.

# GUINEA: Artisanal

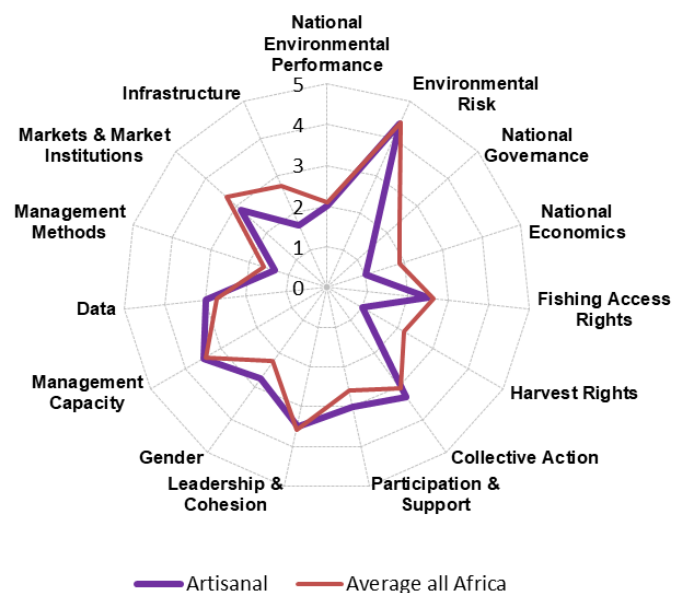
2016

Commercial Fishery	Species	Vessels and Gear	Characteristics	Management	Location
<b>ARTISANAL FISHERY</b>  <b>28,114 Harvesters</b>  <b>6,414 Boat owners</b>  <b>25,420 Processors</b>  <b>60,707 total fishery employment</b>	<ul style="list-style-type: none"> <li>Small Pelagics (74%) Bonga Sardines</li> <li>Minor landings: Barracuda Mullet</li> <li>Demersal (26%) Bobo croaker</li> <li>Minor landings: Catfish Threadfish Shark</li> </ul>	<ul style="list-style-type: none"> <li>5468 small wooden plank boats</li> <li>1877 dugout canoes</li> <li>193 large wooden boats</li> <li>43% of all boats are motorized</li> <li>Gillnets</li> <li>Purse Seine</li> <li>Handline and Set Longlines</li> </ul>	<ul style="list-style-type: none"> <li>Year-round fishing but less in rainy season</li> <li>80% of vessels return daily</li> <li>63% of fish is sold fresh, 36% smoked and 1% salted.</li> <li>Less than 15% of landings go to export.</li> <li>Low levels of infrastructure. Less than 10% of landing sites have electricity, 20% have latrines, 9% have access to ice, and 10% have access to fuel.</li> </ul>	<ul style="list-style-type: none"> <li>Permits by type of net. No limit on the number of permits.</li> <li>Gear restrictions but corruption hinders enforcement.</li> <li>Two established protected zones.</li> <li>No formal co-management but strong harvester organizations.</li> <li>Intrusion and undocumented landings by Senegalese and industrial boats.</li> </ul>	<p>96% local boat owners 3% from Sierra Leone</p>  <p>Credit Wikipedia</p> <p>National-level scores with data from 234 landings sites within 6 prefectures: Boffa, Boke, Conakry, Coyah, Dubreka, and Forecariah</p>

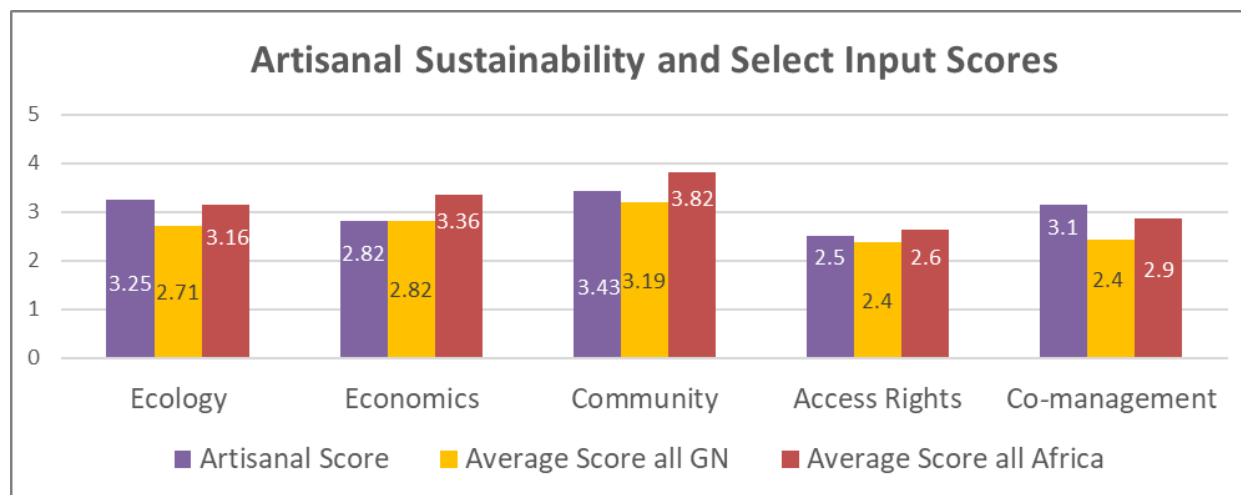
## Artisanal Outputs- Measuring Performance



## Artisanal Inputs- Enabling Performance



\*Note that all Fishery Performance Indicator (FPI) scores are from 1 to 5. The average scores for all African fisheries in the FPI database are presented for the sake of comparison. For a detailed explanation of the FPI Methodology see FPI Manual.



### ***Relative Strengths:***

Ecological indicators are above average:

- Recent advancements in surveillance of illegal fishing means that the stocks primarily targeted by the artisanal sector (bonga and sardines) are relatively stable.
- There are many programs targeted towards protecting vulnerable mangrove habitats.
- Despite these recent changes, demersal stocks are still over-exploited.

Community indicators are above average:

- Wealth appears to be accumulating both sectors, particularly among captains and processing owners who are much less likely to be outsiders than in the rest of West Africa.
- Income in fisheries is generally higher than in other rural occupations except for those who work as employees in the post-harvest sector.
- While access to health care and sanitation are poor, access to education is average.

Co-management inputs are above average:

- Despite the lack of formal co-management in 2016, there is a well-established organization for the artisanal sector (CONAPEG) that is very active in management and assists in enforcing some regulations, including the ban on monofilament nets.
- Social cohesion is strong as stakeholder groups meet regularly and speak with a relatively unified voice. There is more integration of harvest and post-harvest sectors as CONAPEG also represents processors and facilitates investment in smoking centers and some bargaining with international buyers. Women dominate the post-harvest sector and have a strong voice in management and marketing.

### ***Relative Weaknesses:***

Economic indicators are below average:


- Recent bans on international trade with the EU and a lack of infrastructure make product improvement unlikely and keep ex-vessel prices low. A large amount of product is smoked for preservation and sold in local markets.
- There is a high degree of volatility in prices and landings and a lack of formal credit available.

Access Right inputs are below average:

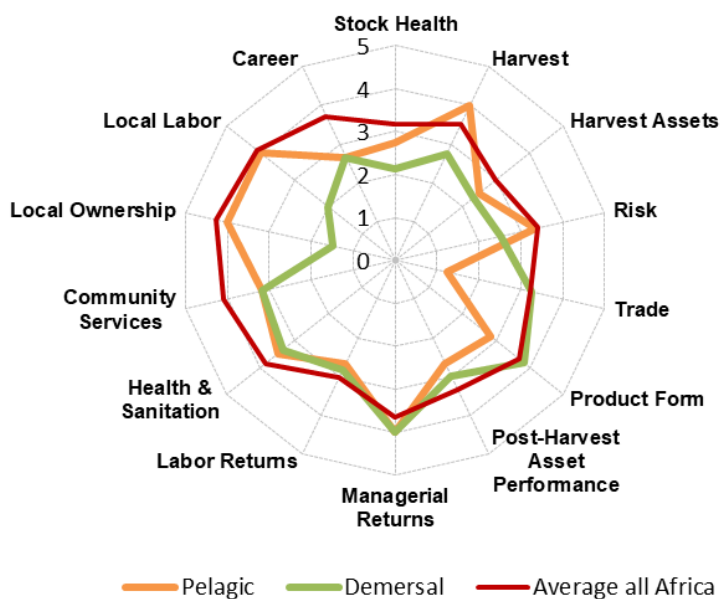
- While permits are sold according to gear type, there is no limit to the number given out and even outsiders can buy permits for the artisanal sector. Enforcement capability is limited.

# GUINEA: Industrial

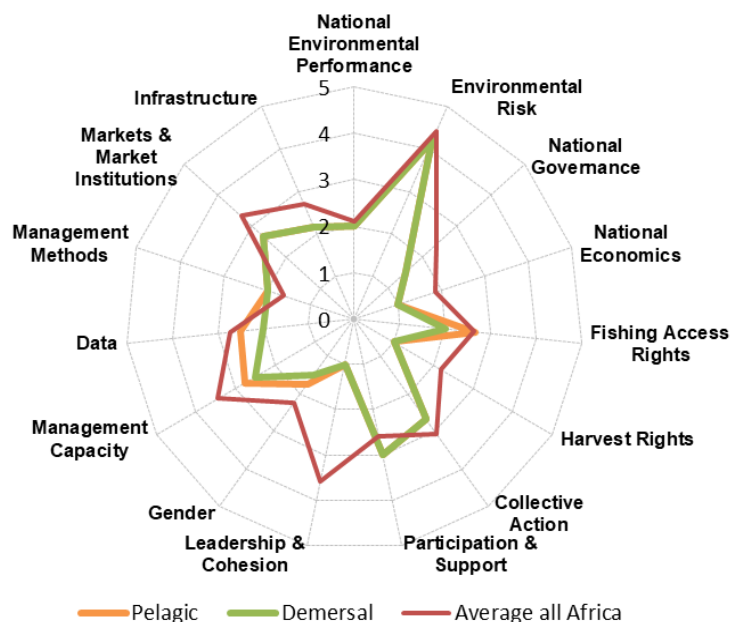
# 2016

Commercial Fishery	Species	Vessels and Gear	Characteristics	Management	Location and Nationality
<b>INDUSTRIAL PELAGIC FISHERY</b>	<ul style="list-style-type: none"> <li>Pelagics</li> <li>Sardines (59%)</li> <li>Chinchard (32%)</li> <li>Mackerel (10%)</li> </ul> <p><i>Minor landings:</i> Bonga Carangides</p>	<ul style="list-style-type: none"> <li>6 large trawl boats</li> <li>Purse Seines</li> <li>Gillnets</li> <li>Roughly 100 crew employed</li> </ul>	<ul style="list-style-type: none"> <li>Almost 100% of landings are frozen and landed in Guinea at 2 Kamsar or Conakry.</li> <li>Some transformation via smoking but all other processing occurs on board.</li> </ul>	<ul style="list-style-type: none"> <li>Licenses are collected and enforced.</li> <li>Two months of closure July-August</li> <li>Prohibited from fishing in artisanal zone (12 miles out).</li> <li>Total allowable catch by sector.</li> <li>Limit on percent of catch rejected.</li> <li>Despite onboard observers, minimal power to enforce regulations especially when fish at night.</li> </ul>	<p>Pelagic: 50% local boat owners 30% local crew</p>  <p>Credit: Wikipedia</p>
<b>INDUSTRIAL DEMERSAL FISHERY</b>	<ul style="list-style-type: none"> <li>Demersal</li> <li>Dorado (65%)</li> <li>Catfish (15%)</li> <li>Red mullet (20%)</li> </ul> <p>24 other stocks *Most boats also pursue octopus</p>	<ul style="list-style-type: none"> <li>28 large trawl boats with authorized mesh size of 70mm</li> <li>Roughly 250 crew employed</li> </ul>	<ul style="list-style-type: none"> <li>Mandatory to land 20% in Guinea but often pay fine and directly export to Asian market.</li> <li>Only juveniles are landed in Guinea.</li> <li>Very little data on post-harvest sector.</li> <li>Violations of no landing at sea ordinance.</li> </ul>		<p>Demersal: 0% local ownership 10% local crew</p> <p>Overall Industrial: 3 Guinean boats, 29 Chinese boats, 2 Korean boats</p>

## Industrial Outputs- Measuring Performance

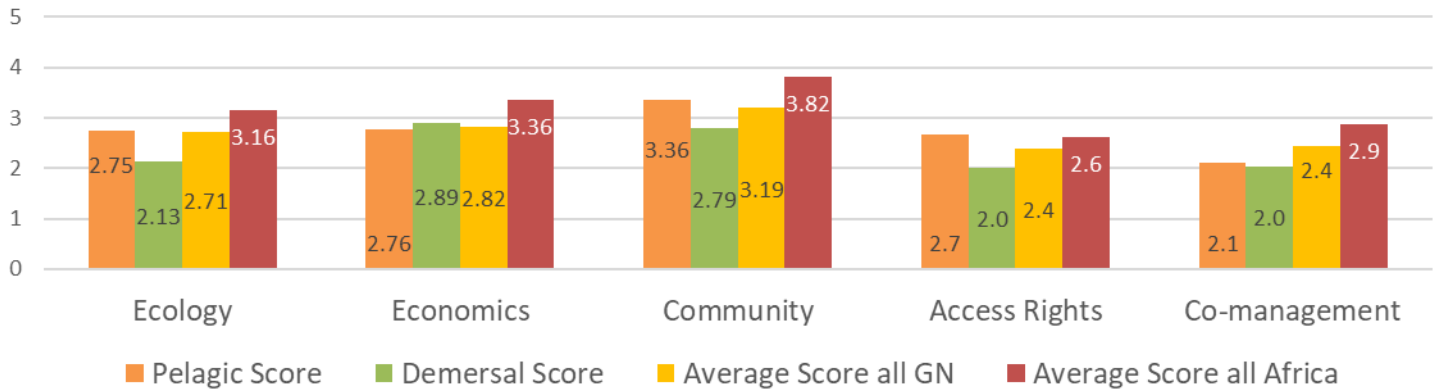


## Industrial Inputs- Enabling Performance



\*Note that all Fishery Performance Indicator (FPI) scores are from 1 to 5. The average scores for all African fisheries in the FPI database are presented for the sake of comparison. For a detailed explanation of the FPI Methodology see FPI Manual or Guinea FPI Report.

## Industrial Sustainability and Select Input Scores



### ***Relative Strengths:***

Community indicators are only slightly below average:

- Although there is a large degree of uncertainty because prices for demersal landings and costs for both sectors are unknown, best guesses suggest that wealth is accumulating in the harvest and post-harvest sectors.
- While the demersal sector is dominated by foreign vessels, local participation in the pelagic sector is relatively high and landings in this sector are also primarily processed by locals. Despite the lack of sanitation in ports, most fishery participants have access to health care and education for their descendants.

Economic indicators are only slightly below average:

- The demersal sector is focused on high-value export species and product improvement while the local processing in the pelagic sector is still primarily focused on preservation through smoking. Both sectors largely export to Asian markets.
- There is no data collected on harvest asset value or access to credit, but best guesses suggest that these indicators are higher than the artisanal sector since industrial harvesters have the support of foreign investors and banks.

### ***Relative Weaknesses:***

Ecological indicators are below average:

- Despite recent advances in surveillance, there is still a large degree of overfishing and demersal stocks in particular are over-exploited.

Access Rights and Co-management inputs are below average:

- There are established catch limits, but access rights are not exclusive in practice since the limit on the number of vessels rarely binds and there is also intimidation of observers and illegal fishing at night that make the TAC difficult to enforce.
- Because the industrial fishery is mainly foreign boats who renew their licenses annually their access rights are less secure than in the artisanal sector.
- Local representatives for foreign fishing companies sometimes band together to try to influence management, but they are generally less organized and have less cohesive leadership than in the artisanal fleet.

Management capacity and infrastructure inputs are low:

- The national government does not have the capacity to enforce regulations at sea so there are illegal transfers to foreign processing boats.
- The lack of domestic infrastructure makes product improvement and local value-added processing unlikely.
- Industrial vessels must travel to other countries for support services because most domestic ports do not have the necessary equipment or reliable access to ice and fuel.

# Appendix B: Surveys for Implementation of FPI Scores (In French)

## GN Enquête pour les FPI (IPP)

### 1. Enquête générale (demander aux experts locaux)

#### A. Ecologie

- A1. List de tous les espèces
- A2. Parmi tous les espèces quelles sont surexploites ou moins débarqué?
- A3. Quels sont les 5 especes les plus importants? (economiquement) list en importance
- A4. Pour les 3 plus important:
- A5. degre de surexploitation (pas surexploite, un peu, moderamment, vraiment, gravement)
- A6. les especes sont en train de baisser ou de augmenter ? (mieux ou pire que l'annee derniere)
- A7. Dans les 5 annees passe vous avez eu un capture accessoire d'une tortue ou mammaux marin ?
- A8. Pensez vous que la plupart des gens la prennent des licences ? Est-ce qu'il y a une probleme avec des etrangers qui n'ont pas de licence ? Avec les pecheurs qui utilise les monofilaments... (qui ne suivent pas les règles)? Pour arriver a une pourcentage des captures/debarquements illegales
- A9. Vous voyez des problèmes écologique avec l'habitat ? avec la pollution ? des catastrophes naturelles ? Lesquelles ?
- A10. Vous voyez des maladies/parasites dans les poissons de ce site ? Lesquelles ? Souvent ?
- A11. Vous prévoyez quelles chocs/menaces dans votre pêcherie ? Décrire

#### B. L'Economie/Sociale

- B1. Nombre de pirogues, et type par localité
- B2. Nombre de propriétaires, propriétaires/capitaines, équipage, vendeuse, transformatrice, assistants des vendeuses/transformatrices par localité
- B3. Pensez vous qu'il ya une probleme avec la capacite excessive ? les pirogues devient plus grand ou il y a plus de pirogues ? (Estimation de nombre de pirogues maintenant est plus qu'en 2010 ?)
- B4. Accident frequents ? Combien d'accidents avec fatalites des pecheurs dans les 5 annees ?
- B5. Est-ce qu'il y a des conflits entre les pecheurs et les vendeuses ? Quel type de conflit ?
- B6. Est-ce qu'il y a des conflits entre les vendeuses ? C'est compétitif ?
- B7. Est-ce qu'il y a des conflits entre les pêcheurs ? C'est compétitif ?
- B8. Est-ce qu'il y a des conflits entre les gestionnaires et les pêcheurs ? Lesquelles ? Si la gestion change (par exemple : limite aux licences, augmenter la prix d'un licence) pensez-vous qu'il y aura des disputes ?
- B9. Les prix changeaient beaucoup pendant 2016 ? Les débarquements changeaient beaucoup dans 2016 ? Les prix sont differents aux autres sites (vous preferez de débarquer a l'exterieur) ? Pourquoi ?
- B10. Nationalite : Quel pourcent de proprietaires sont locaux ? Quel pourcent de l'équipage sont locaux ? pourcent des vendeuses ? des transformatrices ? des assistants ?
- B11. Quelles sont les challenges dans la secteur post-capture dans votre ville ?
- B12. Marche finale et produit finale pour les trois espèces plus importants
- B13. Les entreprises de soutien existent dans votre ville : carburant, mécanique pour les pirogues, les filets, les moteurs, la glace
- B14. Hygiène dans les ports d'embarquement, les centres de traitement : WC ?
- B15. Estimation de pourcent des captures fait avec licence. ? Vous sentez sécurise que le gouvernement ne vas pas changer votre droit d'accès ? Vous sentez comme votre droit d'accès est exclusif ?
- B16. Salaire moyen et activités complémentaires dans la localité

- B17. Est-ce qu'il y a une personnalité locale ou bien une institution qui peut amener les gens à conserver les ressources ? (une mesure qualitative de la force de la direction locale)
- B18. Est-ce qu'il y a des disputes sociales au niveau de la religion, la culture, l'ethnicité ... ? Tout le monde a de la confiance l'un dans l'autre ?
- B19. Décrire l'infrastructure qui existe dans votre ville : la fiabilité de l'électricité, accès à la glace, les routes, les services de transport internationaux...
- B20. Est-ce qu'il y a des ONG ou des gestionnaires du gouvernement qui vous aident à rechercher la pêche ou qui viennent vous donner de l'éducation sur la pêche ?

## 2. Enquête avec le secteur capture (demander aux propriétaires/captains/l'équipage)

- C1. Type de pirogue, vous êtes propriétaire/captain/equipage ? nombre dans l'équipage. Nationalité
- C2. Pour 3 espèces plus importantes : Débarquements total, revenu total, prix moyen au port et au marché (par sortie mais par an à la fin)
- C3. Vous sentez comme les revenus totaux sont mieux aujourd'hui qu'en 2010 ? Comment s'est appliqué votre revenu ? Vous sentez comme les prix sont mieux ? les débarquements ?
- C4. Valeur de pirogue, moteur de pêche... Il coûte plus cher aujourd'hui qu'en 2010 ? Pourquoi ?
- C5. Qui finance les captures ? Quelles sont les taux d'intérêt ? (s'il ne sait pas préciser - dit c'est cher ?)
- C6. Quel âge a la pirogue ? Pensez-vous que la pirogue est bien entretenue (en bon état) ? (voyez avec les yeux)
- C7. Vous êtes un membre de l'association des pêcheurs nationale ? locale ? Combien de jours par mois/an dépensez-vous en réunions pour cette association ? Vous sentez que l'organisation des pêcheurs est puissante dans la gestion ? dans les affaires de post-capture ?
- C8. **(Propriétaire ou propriétaire/capitaine séparément)** Qu'est-ce que vous gagnez en faisant la pêche (par mois) ? Combien de mois par an ? Pensez-vous que c'est plus que le salaire moyen dans votre ville ?
- Quel est votre activité complémentaire ? Dans un jour de travail, pensez-vous que vous gagnez plus en faisant la pêche qu'en l'autre activité ?
  - L'éducation de vos enfants ? (Université/lycée/college/maternelle/rien) Si vos enfants sont tous jeunes, est-ce que c'est possible de les supporter avec votre revenu ?
  - Quelles sont les services médicaux disponibles en votre localité ? Quand quel qu'un dans la famille est malade gravement, vous pouvez dépenser pour aller jusqu'au Conakry ?
  - En général le statut social d'un propriétaire est comme (roi/président/fonctionnaire/mécanicien/serveur/esclave) ?
  - Votre femme est vendeuse/transformatrice ? Vendez-vous avec ta femme ?
  - Nombre de vendeuses avec lequel vous vendez dans un mois ?
  - Pourcentage des embarquements vendus directs aux consommateurs ?
- C9. **(L'Équipage séparément)** Qu'est-ce que vous gagnez en faisant la pêche (par mois) ? Combien de mois par an ? Pensez-vous que c'est plus que le salaire moyen dans votre ville ?
- Quel est votre activité complémentaire ? Dans un jour de travail, pensez-vous que vous gagnez plus en faisant la pêche qu'en l'autre activité ?
  - L'éducation de vos enfants ? (Université/lycée/college/maternelle/rien) Si vos enfants sont tous jeunes, est-ce que c'est possible de les supporter avec votre revenu ?
  - Quelles sont les services médicaux disponibles en votre ville ? Quand quel qu'un dans la famille est malade gravement, vous pouvez dépenser pour aller jusqu'au Conakry ?
  - En général le statut social d'un membre de l'équipage est comme (roi/président/fonctionnaire/mécanicien/serveur/esclave) ?
  - Votre âge
  - Vos années d'expérience

### 3. Enquête avec le secteur post-capture (demander aux vendeuses/transformatrices/leurs assistants)

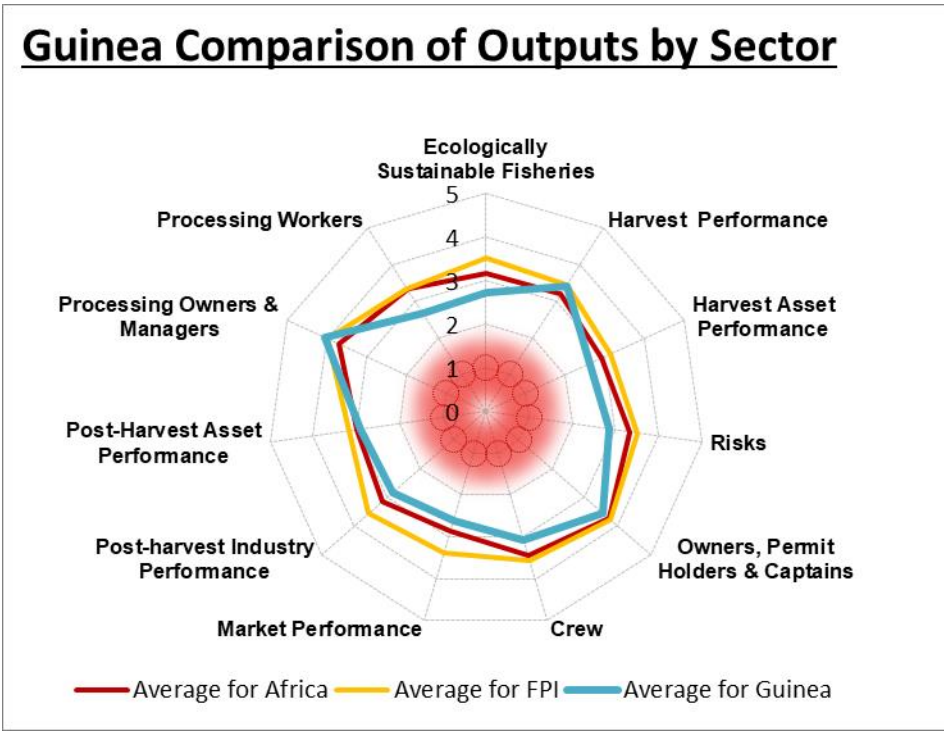
- D1. Vous etes vendeuse ? transformatrice ? assistant ? Nationalite
- D2. Pour les 3 especes plus importants les prix au marche sont mieux ou pire en 2016 qu'en 2010 ?
- D3. Pour les 3 especes plus importants :
- a. la methode de transformation (estimation de pourcent fume, seche, sale, fermente, vendu frais)
  - b. la marche finale (estimation de pourcent consomme local, en Conakry, et a l'export- ou)
- D4. Pour les trois especes plus important :
- a. Premier vendeuse : Vous achetez a quelle prix ? Vous vendez a quelle prix ?
  - b. Prochain vendeuse : Vous achetez a quelle prix ? Vous vendez a quelle prix ?
  - c. Tranformatrice : Vous achetez a quelle prix ? Vous vendez a quelle prix ?
- D5. Pourcentage de pertes post-captures (pourri, vole, animaux, type de perte)
- D6. (Seulement pour les centres de transformation) Nombre de jours travaille par semaine, mois, an ? Le centre de transformation est pleine/a capacite ?
- D7. Qui finance les vendeuses/transformatrices ? Quelles sont les taux d'intérêt ? (si elles ne savent pas précis- dit c'est chère ?)
- D8. Les centres de transformation/les fours sont anciens ? L'age moyenne des centres/fours.
- D9. **(Vendeuse/Transformatrice separement)** Qu'est-ce que vous gagnez en vendant ou en transformant les poissons (par mois) ? Combien de mois par an ? Pensez- vous que c'est plus que le salaire moyen dans votre ville ?
- a. Quel est votre activité complémentaire ? Dans un jour de travail, pensez-vous que vous gagnez plus en vendant/transformant les poissons qu'en l'autre activité ?
  - b. L'éducation de vos enfants ? (Universite/lycee/college/maternelle/rien) Si vos enfants sont tous jeunes, est-ce que c'est possible de les supporter avec votre revenue ?
  - c. Quelles sont les services medicaux disponible en votre ville ? Quand quel qu'un dans la famille est malade gravement, vous pouvez depenser pour aller jusqu'au Conakry ?
  - d. En generale le standing sociale d'une vendeuse/transformatrice est comme (roi/president/fonctionnaire/mechanique/serveur/esclave) ?
- D10. **(Les assistants des vendeuses/transformatrices separément)** Vous etes paye comment ? Qu'est-ce que vous gagnez par mois? Combien de mois par an ? Pensez- vous que c'est plus que le salaire moyen dans votre ville ? Pensez vous que c'est plus qu'une occupation alternative ?
- a. Quel est votre activité complémentaire ? Dans un jour de travail, pensez-vous que vous gagnez plus en faisant la peche qu'en l'autre activite ?
  - b. L'éducation de vos enfants ? (Universite/lycee/college/maternelle/rien) Si vos enfants sont tous jeunes, est-ce que c'est possible de les supporter avec votre revenue ?
  - c. Quelles sont les services medicaux disponible en votre ville ? Quand quel qu'un dans la famille est malade gravement, vous pouvez depenser pour aller jusqu'au Conakry ?
  - d. En generale le standing sociale d'un assistant est comme (roi/president/fonctionnaire/mechanique/serveur/esclave) ?
  - e. Vos anneés d'experience



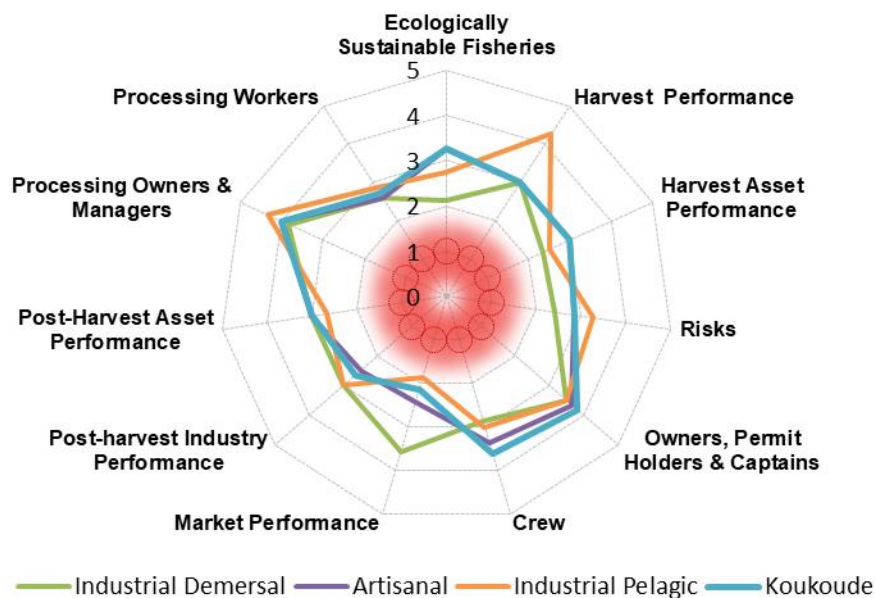
# Appendix C: Additional Figures

## C1: Outputs

Fishery Performance Indicators: OUTPUTS (Measuring Ecological, Harvest and Post-Harvest Sector Performance)								
INDICATOR	DIMENSION	Artisanal SCORE	Koukoude SCORE	Industrial Pelagic SCORE	Industrial Demersal SCORE	AVERAGE GN SCORE	Average all Africa	Average all FPI
Stock Performance	Ecologically Sustainable Fisheries	3.3	3.3	2.8	2.1	2.7	3.2	3.5
Harvest Sector Performance	Harvest Performance	3.0	3.0	4.3	3.0	3.4	3.2	3.4
	Harvest Asset Performance	3.0	3.0	2.5	2.3	2.6	2.9	3.2
	Risks	2.9	2.9	3.3	2.4	2.9	3.3	3.5
	Owners, Permit Holders & Captains	3.7	3.8	3.5	3.5	3.6	3.7	3.8
	Crew	3.4	3.6	3.0	2.9	3.1	3.4	3.6
Post Harvest Performance	Market Performance	2.4	2.1	1.9	3.6	2.6	2.9	3.4
	Post-harvest Industry Performance	2.5	2.7	3.0	3.0	2.8	3.1	3.6
	Post-Harvest Asset Performance	3.0	3.0	2.7	3.0	2.9	3.0	3.2
	Processing Owners & Managers	4.0	4.0	4.3	3.8	4.1	3.7	4.0
	Processing Workers	2.6	2.7	2.9	2.6	2.7	3.3	3.3



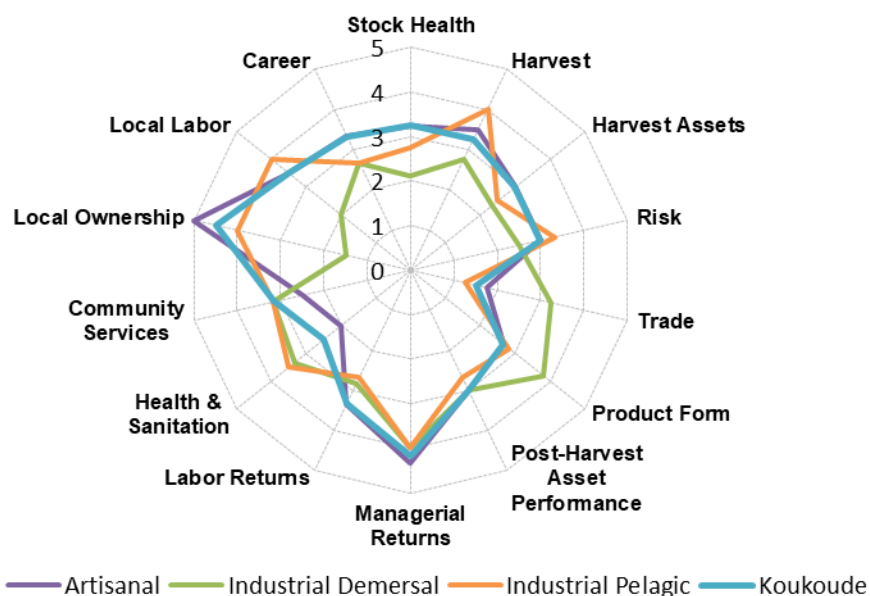
## Individual Fishery Outputs by Sector



**Fishery Performance Indicators: OUTPUTS (Measuring Ecological, Economic, and Community Performance)**

INDICATOR	DIMENSION	Artisanal SCORE	Koukoude SCORE	Industrial Pelagic SCORE	Industrial Demersal SCORE	AVERAGE GN SCORE	Average all Africa	Average all FPI
Ecology	Stock Health	3.25	3.25	2.75	2.13	2.71	3.16	3.50
Economics	Harvest	3.50	3.25	4.00	2.75	3.42	3.52	3.50
	Harvest Assets	3.00	3.00	2.50	2.33	2.61	2.98	2.94
	Risk	3.00	3.00	3.33	2.50	2.94	3.41	3.23
	Trade	1.75	1.50	1.25	3.25	2.08	3.24	2.49
	Product Form	2.67	2.67	2.83	3.83	3.11	3.68	3.18
	Post-Harvest Asset Performance	3.00	3.00	2.67	3.00	2.89	3.35	2.95
Community	Managerial Returns	4.33	4.17	4.00	4.00	4.11	3.64	3.69
	Labor Returns	3.33	3.33	2.67	2.83	2.94	3.02	3.23
	Health & Sanitation	2.00	2.50	3.50	3.33	2.94	3.86	2.95
	Community Services	2.50	3.17	3.17	3.17	2.94	4.11	3.36
	Local Ownership	5.00	4.50	4.00	1.50	3.50	4.26	3.79
	Local Labor	3.50	3.50	4.00	2.00	3.17	4.12	4.04
	Career	3.33	3.33	2.67	2.67	2.89	3.72	3.92

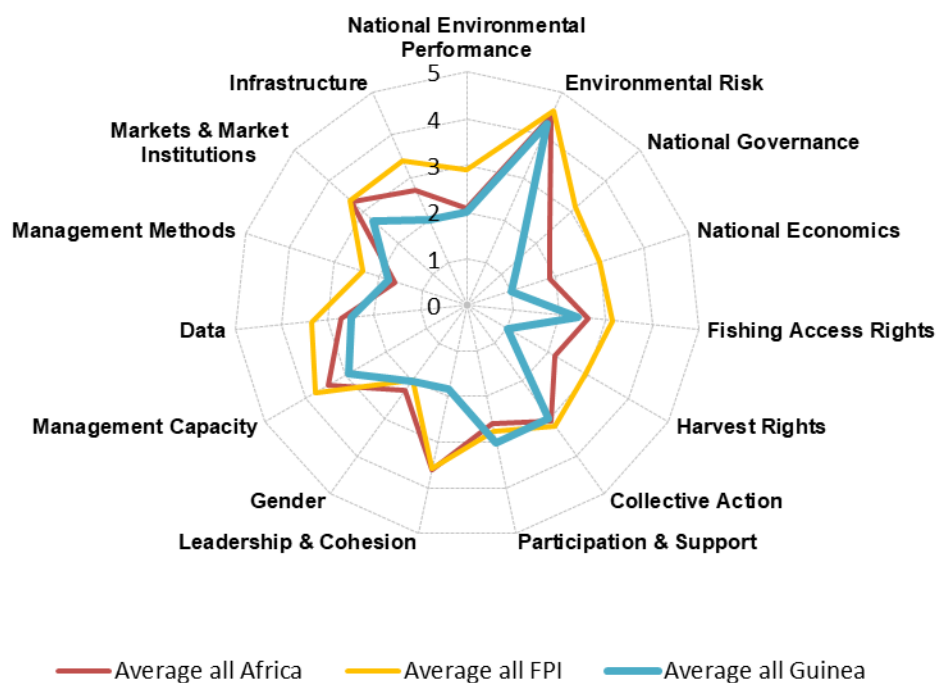
## Individual Fishery Comparison of Outputs



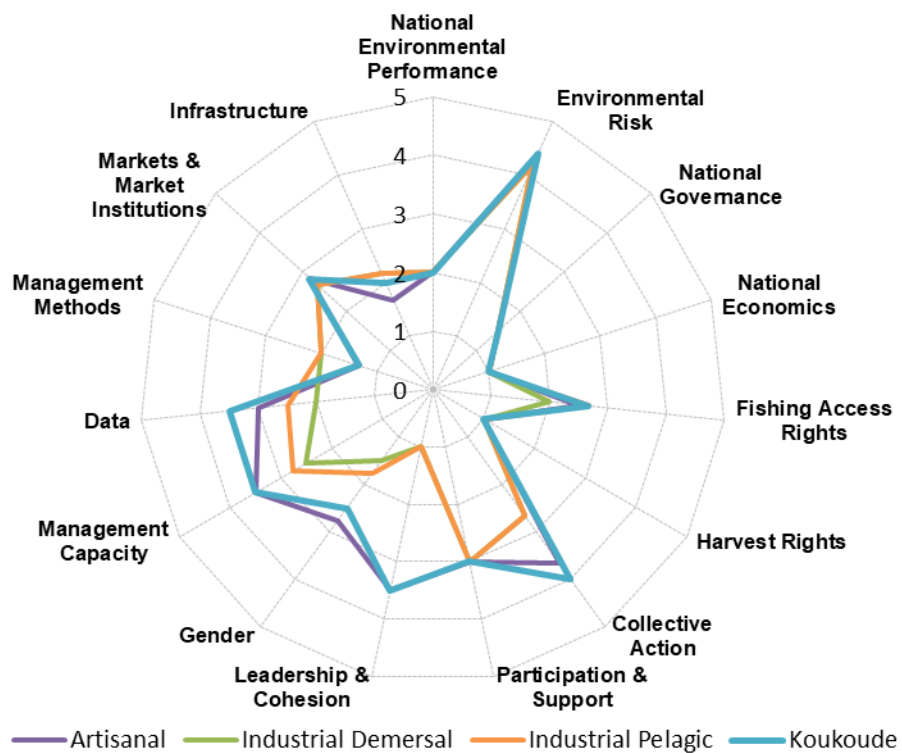
## C2: Inputs

Fishery Performance Indicators: INPUTS (Enabling Performance)								
COMPONENT	DIMENSION	CAIO SCORE	VARELA SCORE	BIOMBO SCORE	BUBA SCORE	AVERAGE GB SCORE	Average all Africa	Average all FPI
Macro Factors	National Environmental Performance	1.0	1.0	1.0	1.0	1.0	2.1	2.9
	Environmental Risk	4.8	4.6	4.8	4.8	4.8	4.4	4.6
	National Governance	1.5	1.5	1.5	1.5	1.5	2.4	3.1
	National Economics	1.0	1.0	1.0	1.0	1.0	1.9	3.0
Property Rights & Responsibility	Fishing Access Rights	2.3	2.7	2.3	2.8	2.5	2.6	3.1
	Harvest Rights	1.0	1.0	1.0	1.0	1.0	2.2	2.9
Co-Management	Collective Action	2.3	3.0	2.3	3.7	2.8	3.1	3.2
	Participation & Support	2.5	2.5	2.5	3.5	2.8	2.6	2.8
	Leadership & Cohesion	3.5	4.5	3.0	5.0	4.0	3.6	3.6
	Gender	3.0	2.8	2.8	2.8	2.8	2.3	2.0
Management	Management Capacity	3.5	3.5	3.5	3.8	3.6	3.4	3.8
	Data	3.0	3.0	3.0	3.0	3.0	2.7	3.3
	Management Methods	1.0	1.0	1.0	2.7	1.4	1.6	2.4
Post-harvest	Markets & Market Institutions	2.3	2.7	2.5	2.5	2.5	3.3	3.4
	Infrastructure	1.2	1.5	1.5	1.8	1.5	2.7	3.4

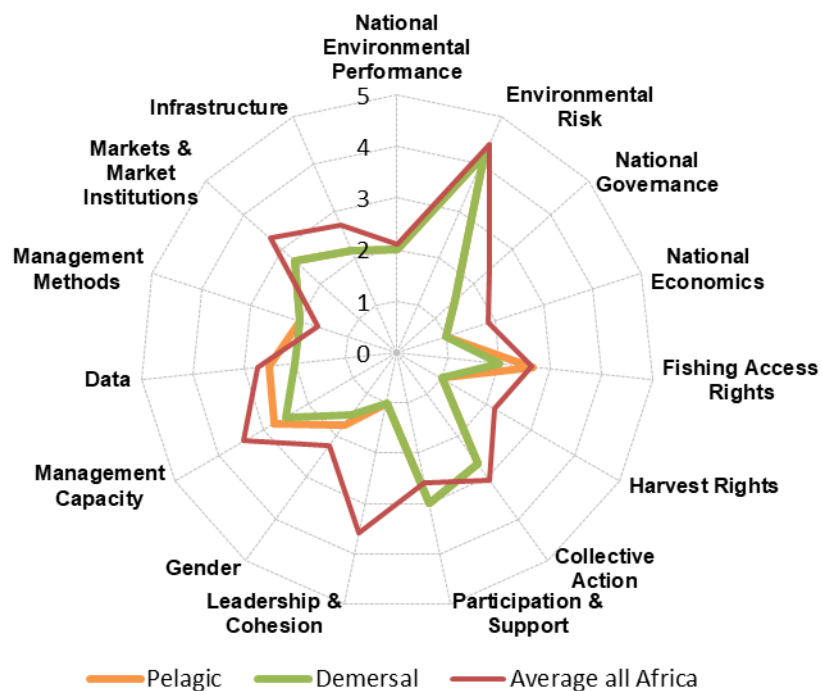
## Guinea Comparison of Inputs



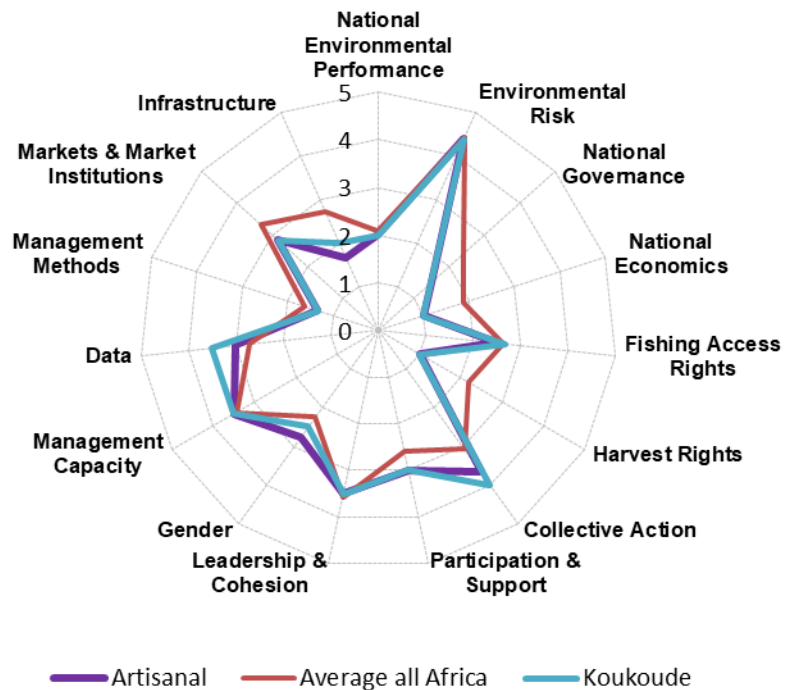
## Individual Fishery Comparison of Inputs



## Industrial Inputs- *Enabling Performance*



## Artisanal Inputs- *Enabling Performance*



# Appendix D: Full Set of FPI Scores for Each Fishery

Fishery Performance Indicators: <b>Inputs (Enabling Wealth Creation)</b>										
Component	Dimension	Measure	Artisanal Score	Artisanal Summary	Koukoude Score (K)	Koukoude Summary	Industrial Pelagic (IP)	IP Summary	Industrial Demersal (ID)	ID Summary
Macro Factors	General Environmental	Environmental Performance Index (EPI)	2	2.0	2	2.0	2	2.0	2	2.0
	Exogenous Environmental Factors	Disease and Pathogens	4	4.4	4	4.4	4	4.2	4	4.2
		Natural Disasters and Catastrophes	4		4		4		4	
		Pollution Shocks and Accidents	5		5		5		5	
		Level of Chronic Pollution (Stock effects)	4		4		4		4	
		Level of Chronic Pollution (Consumption effects)	5		5		4		4	
	Governance	Governance Quality	1	1.5	1	1.5	1	1.5	1	1.5
		Governance Responsiveness	2		2		2		2	
	Economic Condition	Index of Economic Freedom	1	1.0	1	1.0	1	1.0	1	1.0
		Gross Domestic Product (GDP) Per Capita	1		1		1		1	
Property Rights & Responsibility	Fishing Access	Proportion of Harvest Managed Under Limited Access	3	2.5	4	2.7	5	2.7	2	2.0
		Transferability Index	1		1		1		1	
		Security Index	4		4		3		2	
		Durability Index	4		4		3		3	
		Flexibility Index	2		2		2		2	
		Exclusivity Index	1		1		2		2	
	Harvest Rights	Proportion of Harvest Managed with Rights-based Management	1	1.0	1	1.0	1	1.0	1	1.0
		Transferability Index	NA		NA		NA		NA	
		Security Index	NA		NA		NA		NA	
		Durability Index	NA		NA		NA		NA	
		Flexibility Index	NA		NA		NA		NA	
		Exclusivity Index	NA		NA		NA		NA	
Co-Management	Collective Action	Proportion of Harvesters in Industry Organizations	4	3.7	5	4.0	3	2.7	3	2.7
		Harvester Organization Influence on Fishery Management & Access	4		4		3		3	
		Harvester Organization Influence on Business & Marketing	3		3		2		2	
	Participation	Days in Stakeholder Meetings	4	3.0	4	3.0	2	3.0	2	3.0
		Industry Financial Support for Management	2		2		4		4	
	Community	Leadership	2	3.5	2	3.5	1	1.0	1	1.0
		Social Cohesion	5		5		1		1	
	Gender	Business Management Influence	3	2.8	3	2.5	2	1.8	2	1.5
		Resource Management Influence	2		2		1		1	
		Labor Participation in Harvest Sector	1		1		1		1	
		Labor Participation in Post-Harvest Sector	5		4		3		2	
Management	Management Inputs	Management Expenditure to Value of Harvest	4	3.5	4	3.5	3	2.8	3	2.5
		Enforcement Capability	2		2		2		1	
		Management Jurisdiction	3		3		3		3	
		Level of Subsidies	5		5		3		3	
	Data	Data Availability	3	3.0	4	3.5	2	2.5	2	2.0
		Data Analysis	3		3		3		2	
	Management Methods	MPAs and Sanctuaries	2	1.3	2	1.3	2	2.0	2	2.0
		Spatial Management	1		1		1		1	
		Fishing Mortality Limits	1		1		3		3	
Post-harvest	Markets & Market Institutions	Landings Pricing System	4	2.8	4	2.8	3	2.7	2	2.7
		Availability of Ex-vessel Price & Quantity Information	2		2		2		2	
		Number of Buyers	4		4		3		3	
		Degree of Vertical Integration	2		2		3		3	
		Level of Tariffs	4		4		3		3	
		Level of Non-tariff Barriers	1		1		2		3	
	Infrastructure	International Shipping Service	2	1.7	2	2.0	2	2.2	2	2.2
		Road Quality Index	1		1		1		1	
		Technology Adoption	2		2		3		3	
		Extension Service	2		3		1		1	
		Reliability of Utilities/Electricity	1		1		2		2	
		Access to Ice & Refrigeration	2		3		4		4	

Fishery Performance Indicators: <b>Outputs (Measuring Wealth)</b>											
Component	Dimension	Sust. Category	Measure	Artisanal Score	Artisanal Summary	Koukoude Score (K)	Koukoude Summary	Industrial Pelagic (IP)	IP Summary	Industrial Demersal (ID)	ID Summary
Ecologically Sustainable Fisheries	Fish Stock Health & Environmental Performance	Ecology	Percentage of Stocks Overfished	3	3.3	3	3.3	3	2.8	2	2.1
		Ecology	Degree of Overfishing	3		3		3		2	
		Ecology	Overfishing or Rebuilding	3		3		2		2	
		Ecology	Regulatory Mortality	5		5		3		3	
		Ecology	Selectivity	4		4		4		3	
		Ecology	Illegal, Unregulated or Unreported Landings	3		3		2		1	
		Ecology	Status of Critical Habitat	4		4		4		3	
		Ecology	Proportion of Harvest with a 3 <sup>rd</sup> Party Certification	1		1		1		1	
Harvest Sector Performance	Harvest Performance	Economics	Landings Level	2	3.0	2	3.0	4	4.3	1	3.0
		Economics	Excess Capacity	2		2		4		4	
		Economics	Season Length	5		5		5		3	
		Community	Harvest Safety	3		3		4		4	
	Harvest Asset Performance	Economics	Ratio of Asset Value to Gross Earnings	1	3.0	1	3.0	1	2.5	1	2.3
		Economics	Total Revenue versus Historic High	3		3		4		3	
		Economics	Asset (Permit, Quota) Value versus Historic High	5		5		2		2	
		Economics	Borrowing Rate Relative to Risk-free Rate	3		3		3		3	
		Economics	Source of Capital	2		2		3		3	
		Economics	Functionality of Harvest Capital	4		4		2		2	
	Risk	Economics	Annual Total Revenue Volatility	2	2.9	2	2.9	2	3.3	2	2.4
		Economics	Annual Landings Volatility	5		5		5		4	
		Economics	Intra-annual Landings Volatility	3		3		3		2	
		Economics	Annual Price Volatility	3		3		3		2	
		Economics	Intra-annual Price Volatility	3		3		3		2	
		Economics	Spatial Price Volatility	2		2		4		3	
		Community	Contestability & Legal Challenges	2		2		3		2	
	Owners, Permit Holders & Captains (Those holding the right or ability to access)	Community	Earnings Compared to National Average Earnings	5	3.7	5	3.8	3	3.5	4	3.5
		Community	Fishery Wages Compared to Non-fishery Wages	5		5		3		4	
		Community	Education Access	2		3		4		4	
		Community	Access to Health Care	2		3		4		4	
		Community	Social Standing of Boat Owners and Permit Holders	3		3		4		4	
		Community	Proportion of Nonresident Employment	5		4		3		1	
	Crew (Those depending on others for access)	Community	Earnings Compared to National Average Earnings	4	3.4	4	3.6	3	3.0	3	2.9
		Community	Fishery Wages Compared to Non-fishery Wages	5		5		4		4	
		Community	Education Access	2		3		3		3	
		Community	Access to Health Care	2		3		3		3	
		Community	Social Standing of Crew	3		3		3		3	
		Community	Proportion of Nonresident Employment	3		3		3		2	
		Community	Crew Experience	5		5		3		3	
		Community	Age Structure of Harvesters	3		3		2		2	
Post Harvest Performance	Market Performance	Economics	Ex-vessel Price versus Historic High	5	2.4	4	2.1	3	1.9	3	3.6
		Economics	Final Market Use	2		2		3		4	
		Economics	International Trade	2		1		1		5	
		Economics	Final Market Wealth	1		1		1		3	
		Economics	Wholesale Price Relative to Similar Products	2		2		2		2	
		Economics	Capacity of Firms to Export to the US & EU	2		2		1		3	
		Economics	Ex-vessel to Wholesale Marketing Margins	3		3		2		5	
	Post-harvest, Processing & Support Industry Performance	Economics	Processing Yield	2	2.5	2	2.7	3	3.0	3	3.0
		Economics	Shrink	3		3		4		4	
		Economics	Capacity Utilization Rate	4		4		4		4	
		Economics	Product Improvement	2		2		1		3	
		Community	Sanitation	1		1		4		2	
		Community	Regional Support Businesses	3		4		2		2	
	Post-Harvest Asset Performance	Economics	Borrowing Rate Relative to Risk-free Rate	3	3.0	3	3.0	3	2.7	4	3.0
		Economics	Source of Capital	2		2		2		3	
		Economics	Age of Facilities	4		4		3		2	
	Processing Owners & Managers	Community	Earnings Compared to National Average Earnings	5	4.0	4	4.0	5	4.3	4	3.8
		Community	Manager Wages Compared to Non-fishery Wages	5		5		5		4	
		Community	Education Access	4		4		4		5	
		Community	Access to Health Care	2		3		3		4	
		Community	Social Standing of Processing Managers	3		3		4		4	
		Community	Nonresident Ownership of Processing Capacity	5		5		5		2	
	Processing Workers	Community	Earnings Compared to National Average Earnings	2	2.6	2	2.7	2	2.9	2	2.6
		Community	Worker Wages Compared to Non-fishery Wages	4		4		2		2	
		Community	Social Standing of Processing Workers	2		2		2		3	
		Community	Education Access	2		3		3		3	
		Community	Access to Health Care	2		2		3		3	
		Community	Proportion of Nonresident Employment	4		4		5		2	