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THE RAPID TRANSFORMATION OF THE FISH VALUE CHAIN IN NIGERIA: EVIDENCE FROM KEBBI STATE

By

Ayuba Gona, Gwoni Woji, Sunday Norbert, Hajaru Muhammad,
Lenis S. O. Liverpool-Tasie, Thomas Reardon, Ben Belton

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AUTHORS

A Gona is a Senior lecturer in the Department of Agricultural Economics and Extension at Kebbi State University of Science and Technology, Aliero

Gwoni Woji is a fish farmer in Abuja, FCT, Nigeria

Sunday Norbert is a student in the Department of Agricultural Economics at Kebbi State University of Science and Technology, Aliero

Hajaru Muhammad is a student in the Department of Agricultural Economics at Kebbi State University of Science and Technology, Aliero

Lenis S. O. Liverpool-Tasie is Associate Professor at Michigan State University (MSU)

T. Reardon is Professor at Michigan State University (MSU)

Ben Belton is Assistant Professor of International Development at Michigan State University

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1. INTRODUCTION

Africa is rapidly urbanizing, and both urban and rural households have rapidly transforming diets (Tschirley et al., 2015). There is a clear diversification beyond staples into animal proteins (including fish) and horticultural products. In Nigeria, animal proteins alone account for 15% and 20% of the food budget share in rural and urban areas respectively. As incomes rise and Bennett's law sets in (where the share of non-staples in the diet rises disproportionately with income), Nigerians are eating much more fish. Fish constitutes 10% of food expenditure by urban and rural Nigerians – as much as rice or tubers or pulses! Fish is more than half the expenditure on animal proteins.

There is a large excess demand comparing total fish consumption and total fish production (the sum of farm-grown fish and capture fisheries output). The sum of capture fishing output from rivers and lakes fluctuates between 500,000 to 700,000 tons of fish per year. However, Nigeria is estimated (based on current consumption rates) to "need" at least 2.7 million tons of fish per year (Momoh, 2009; Dauda, 2010; APP, 2016). Meeting this need (and the rising demand tending toward the level of need) is coming from two sources. One supply source that addresses excess demand for fish is from imports. But these are seen to drain foreign exchange and compete with the developing aquaculture sector. The government has been imposing quotas on fish imports but imports continue to be substantial. The other supply source is domestic aquaculture (the farmed fish sector); the government is working to encourage private investment in domestic aquaculture to substitute for imports.

Nigeria is the second largest producer of farmed-fish in Africa (after Egypt). Fish-farming is important to meet the growing demand. Over the years, successive governments in Nigeria have recognized the relevance of the fisheries subsectors, being crucial to food security, poverty alleviation, employment generation, source of income/livelihood, and wellbeing. Several attempts were made in recent times to boost the sectors' productivity through institutional reforms and various fiscal and economic measures. Some of these measures involve tax exemptions and input subsidy schemes for distribution to fishers and fish farmers to stimulate increased production. Despite these interventions, the sector showed a deficit in the supply to meet the demand of fish by the populace.

This study presents the results from a meso-inventory conducted in Kebbi State, Northern Nigeria between March and July 2018. We explore he extent to which the farmed-fish value chain is transforming structurally and the roles of capture fishing versus farmed fish. Kebbi is one of Nigeria's leading states for fish production. Though largely Sudan Savanna (in the north) and Northern Guinea savanna (in the south), and thus semi-arid tropics, there is still a lot of water and a lot of fish. Kebbi's role in fish production stems from the presence of the longest river in West Africa (River Niger) in the State. River Niger traverses about 374 km within the state. (Raji et al., 2008). Furthermore, the establishment (creation) of Kainji Lake (a reservoir built 1964-68) on the River Niger, with 50% of the surface water in Kebbi State, also facilitated the emergence of fish farming in the state.

Figure 1: shows that Kebbi State shares an international border with the Republic of Benin and the Republic of Niger to the West and North respectively. It also shares domestic borders with Sokoto, Zamfara, and Niger states. Thus Kebbi is an important hub serving numerous states in the north as well as neighboring countries.

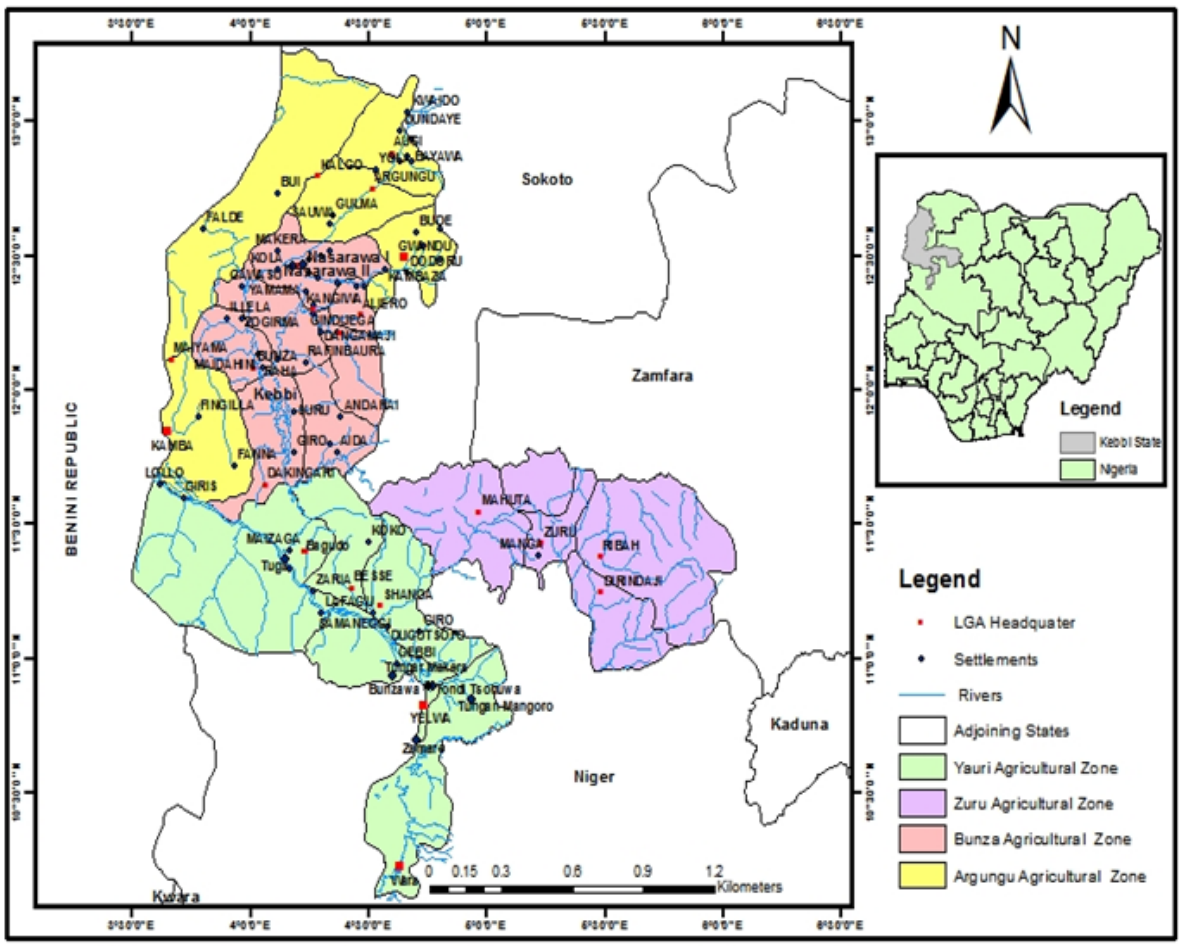

Figure 1: Map of Kebbi State showing the major aquaculture clusters (Source: key informants interviewed by the research team

2. METHOD

This study is a meso level-inventory of the spatial and size distribution and thus concentration of actors in the key segments of the fish value chain in both states. To select our study zones, a field-based "rapid reconnaissance" was conducted to identify the major clusters of fish production (fishers and fish farms). This was used to update a base list of actors generated via a stakeholder consultation and a series of key informant interviews. Next the validity of the identified areas was confirmed with officials of the Ministry of Animal Health, Husbandry, and Fisheries of Kebbi State. This led to four key production zones or clusters being identified.

To arrive at the sample for the study, we adopted the method of sampling implemented by Hernandez et al. (2017) in their study on the "quiet revolution" in the aquaculture value chain in Bangladesh. First, a listing of actors - zone by zone, local government by local government, village by village – was done per segment of the farmed fish and captured fish value chains hatcheries for farms, feed mills for farms, fish farms, fishers, (captured and farmed) fish wholesalers, processors, transporters, and retailers. Third, the "snowballing" technique was adopted to identify new locations missed in the initial classification/listing of areas; these turned out to be mainly new areas of activity that had recently developed in the subsector. The sample list is shown in the annex.

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3. RESULTS

Tables 1-8 show for Kebbi State the structural change represented by changes over a decade per value chain segment in the numbers and shares of actors by size strata. We discuss this segment by segment. We expect the northern agroecological region (Argungu and Bunza) to differ from the rest of the zones in the southern region. We note this where relevant in the results.

Overall the Kebbi State data show rapid growth in the number of fish farms, fishers, and fish traders, but slow or no growth in fish farm input segments (local hatcheries and feed mills) and a small reduction in fish processors (drying, smoking).

Table 1. Structural changes of hatcheries in 10 years

Zone	Hatcheries														
	Total number			Small (farms only)			Large (farms only)			Small (farms & sales)			Large (farms & sales)		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	4	4	5	25%	0%	0%	50%	50%	40%	0%	0%	20%	25%	0%	40%
Bunza	2	2	0	0%	0%	0%	0%	0%	0%	0%	100%	0%	100%	0%	0%
Zuru	1	0	0	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yauri	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	7	6	5	29%	0%	0%	29%	33%	40%	0%	33%	20%	42%	4%	40%

Source: Fish value chain meso level survey, 2018

Table 1 shows structural change in the hatcheries segment. Several points are salient.

First, given that we found there to be nearly 1400 fish farms in the study zones, our finding here that there are only 7 hatcheries is surprising. Several possibilities exist including the following (1) It is possible that the 6 large farms with hatcheries may be supplying very large numbers of fingerlings sufficient to meet more of the demand; (2) fish farmers may depend on collecting their own fingerlings from rivers; (3) farmers may raise their own fingerlings from roe purchased from outside the state; (4) farmers may purchase fingerlings from outside the study zones in Kebbi State or elsewhere. The latter is consistent with anecdotal evidence from visits to the fish wholesale market in Abuja where there was an active fingerling market sending fingerlings to various states including Kebbi State. Perhaps fingerlings also come up from the large fish farming area in the Southwest. These are hypotheses to be tested in further work.

However, these all indicate a need for a more in-depth study of hatcheries in the state and across the country. Second, spatially the few hatcheries are concentrated in Argungu and Bunza in the North. This reflects the emergence of hatcheries in Labana Farm, at Aliero, Mustee Global Farms at Jega,

Sarkin Shiko Farms at Kamba, and Nasarawa Farms at Birnin Kebbi. As aquaculture grows in Kebbi, the role of these few hatcheries in the input supply chain for aquaculture in Kebbi needs to be better understood.

Table 2: Structural changes of feed mills in 10 years

Zone	Feed Mills								
	Total number			Small (Farm only)			Medium (Farm only)		
	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	4	3	2	100%	100%	100%	0%	0%	0%
Bunza	0	0	0	0%	0%	0%	0%	0%	0%
Zuru	1	1	1	0%	0%	0%	100%	100%	100%
Yauri	0	0	0	0%	0%	0%	0%	0%	0%
All	5	4	3	80%	75%	67%	20%	25%	33%

Source: Fish value chain meso level survey, 2018

Table 2 shows structural change in the feed mill segment. Several points are salient. Again as with hatcheries, given that we found there to be nearly 1400 fish farms in the study zones, our finding here that there are only 5 feed mills (of which 4 are small) and they are all in the North (so none locally serving the south) is surprising.

Several possibilities exist including the following (1) fish farmers may make their own feed from purchased or home-grown ingredients; (2) they may rely partly on manure and fertilizer to form phytoplankton then zooplankton in the water for the fish to consume; (3) they may purchase bagged feed from outside the study zones in Kebbi State or in other states (sold to them locally by feed traders). The latter is consistent with observations at the fish wholesale market in Abuja that there was an active feed market and large feed mills both in that area and in the Southwest and Northern Nigeria that send feed out around the country.

Table 3. Structural changes among fishers 10 years

Zone	Fishers											
	Total number			Small in total number			Medium in total number			Large in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	4303	3007	2404	21%	21%	21%	35%	32%	34%	44%	47%	45%
Bunza	5280	3901	3100	28%	33%	28%	32%	31%	33%	40%	36%	40%
Zuru	1095	855	626	19%	20%	19%	45%	47%	48%	36%	33%	33%
Yauri	8799	5969	4571	22%	19%	21%	27%	28%	28%	51%	53%	51%
All	19477	13732	10701	23%	23%	23%	31%	31%	32%	46%	46%	45%

Source: Fish value chain meso level survey, 2018

Table 3 shows results for capture fisheries in Kebbi State. Several points stand out. First, despite our hearing in the stakeholder meetings of the demise of capture fisheries in the zone, in fact we report large increases in fishers over the decade. Across the four zones, our survey data show that there was a 182% increase in fishers over the ten years, with the rate of growth fastest in Yauri (192%) in the South, and slowest in Argungu (171%) in the North.

Second, there is a high concentration of the state's fishers in the South, in Yauri, which steadily has about 45% of the fishers. Yauri is laced with tributaries of the River Niger. It appears that fishing has become a key livelihood strategy too.

Third, the concentration is not only spatial, it is in the size distribution of fishers. In Yauri half the fishers are in the large category, and in the North, around 40-45%. This means that in volume terms the share of fish caught by larger fishers might be 70-75%. Alternatively, this may also imply that there is a bimodal pattern where larger fishers with adequate equipment and boats and more commercial aims vie for fish with small poorly equipped fisher folk aimed at home consumption and bare cash incomes. These are hypotheses to test with a micro survey.

Finally, whereas below for fish farms we find a lot of shifts of shares of different farm size strata over the decade, the shares for fishers size strata stay very stable over the years, controlling for zone, and yet their total numbers rise. The reasons for this stability need further exploration.

Table 4: Structural changes of the fish farm sector in 10 years

Zone	Fish Farmers														
	Total number			Small in total number			Medium in total number			Large in total number			Extra-Large in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	138	80	45	62%	68%	69%	22%	19%	18%	9%	6%	7%	4%	8%	76%
Bunza	169	98	56	41%	65%	73%	41%	24%	20%	14%	10%	7%	4%	0%	0%
Zuru	9	4	2	22%	50%	50%	45%	0%	0%	11%	25%	0%	22%	25%	50%
Yauri	1051	817	580	64%	59%	61%	26%	27%	25%	10%	14%	14%	0%	0%	0%
All	1367	999	683	61%	60%	62%	28%	26%	24%	10%	13%	13%	1%	1%	1%

First, while stakeholder meetings emphasized the challenges of the aquaculture sector, the simple facts tell us that it is growing very substantially, and even faster than the number of fishers. The number of fish farmers across the four zones grew 200%, from 683 in 2008 to 1367 in 2018. This rate of growth of numbers of farmers is even greater than that of Bangladesh in 2004 to 2014, qualified as a "Quiet Revolution" in aquaculture in Bangladesh (Hernandez et al. 2018).

Second, not shown in the table, we found the great majority of fish (at least per meso informants) to be Asian catfish, African catfish, and Tilapia (Nile Perch).

Third, as Yauri dominated with nearly half of fishers, it does even more with fish farmers, around 75% in 2018. But note that it had 85% of fish farms in 2008, so aquaculture is spreading beyond these initial highly-watered areas with dense set of rivers.

Fourth, the size distribution per zone is interestingly similar over the zones with two exceptions. There is a far greater share of small farmers in Arunguru and Yauri in the north and south, compared with Zuru and Bunza. It makes sense that Yauri would have such a large share of its farmers (two thirds) being small, as water access is easy. We heard that fishers convert to fish farming there also, but need to test that hypothesis in the micro survey. Moreover, in Bunza and Zuru, the share of small

farmer's declines over time and the medium farmers rise. Again, we do not know why this concentration is occurring. But in the other two zones there is more stability in the size distribution.

By contrast, it is quite striking that in Zuru in the south a large share (half in 2008, then a quarter in the past 5 years) were "extra-large". This is unique in the zones in shares of fishers (although keep in mind that a mere 5% of fishers being extra-large might mean, had we the specific figures of fish they catch, that as much as a quarter of fish are by these extra-large players in the south.

Table 5: Structural change among Rural Fish Wholesalers over 10 years

Zone	Rural Wholesalers											
Zone	Total number			Small in total number			Medium in total number			Large in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	543	495	521	45%	42%	39%	35%	38%	40%	19%	24%	20%
Bunza	482	427	418	44	45%	45%	37%	33%	36%	21%	18%	19%
Zuru	53	40	26	70%	80%	88%	25%	18%	12%	5%	2%	0%
Yauri	1629	1330	1155	50%	56%	59%	34%	32%	30%	16%	12%	11%
All	2707	2292	2120	48%	51%	52%	35%	33%	34%	17%	16%	14%

Source: Fish value chain meso level survey, 2018

First, the most striking thing is to compare the number of fish producers versus rural fish traders. The number of fish producers - fishers and fish farmers - was about 21,000 in all in 2018, and 11,000 in 2008. Rural traders went from about 2120 to 2707. The sector grew in numbers, but at a slower rate than fishers/farmers (traders grew 1.3 times over the decade while fish producers grew 1.9 times). The ratio of fish producers to rural fish traders (hence at least part of the client base of rural traders, as other clients may be traders from other zones or states from whom they buy fish) rose from 5.2 in 2008 (11/2.1) to 7.8 (21/2.7) in 2018. As even 8 farmers as the supply base for a trader seems quite small, we note that it is clear that traders are also buying from inside but in other zones, and outside Kebbi State. With meso data alone we cannot know how much traders buy from outside Kebbi or inside, whether they only deal in fish, and so on. Those questions need to be addressed at the micro level.

Second, that there is average growth in the mean size of traders is corroborated by the finding that there is a steady rise in the share of large and medium traders especially in Yauri, and a decline in the share of small traders.

Third, as with fishers and fish farmers, fish traders are highly concentrated spatially into Yauri. In fact Yauri's share of traders in the state went from 55% to 60% over the decade. Compare this to Yauri's share of fish producers (farms and fisherman): 45 to 47% over the decade. For some reason the trader population is more dominated by Yauri than the production/capture of fish. This needs to be explored further. It may be that fish traders from other states or zones sell in Yauri and may also buy, drawn by the "large fish sector cluster" nature of the zone.

Fourth, overall there is only 1.3 times growth in rural traders (less than the doubling of fish producers): there is little growth in rural trader numbers in the North (1.0 and 1.2 for the two northern zones as the ratio of 2018 to 2008). But in the South the ratios are 2.0 and 1.4 (the latter for Yauri zone). Given that Zuru is tiny in size of fish sector compared with Yauri, we thus find that nearly all of the trader numbers growth in Kebbi come from only Yauri.

Table 6. Structural change among Urban Fish Wholesalers over 10 years

Zone	Urban Wholesalers											
Zone	Total number			Small in total number			Medium in total number			Large in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	150	140	160	67%	64%	63%	27%	34%	31%	6%	2%	6%
Bunza	274	267	263	36%	42%	48%	48%	43%	39%	16%	15%	13%
Zuru	9	5	3	11%	0%	0%	22%	20%	33%	67%	80%	67%
Yauri	815	633	532	33%	29%	42%	48%	51%	34%	19%	20%	24%
All	1248	1045	958	38%	37%	47%	46%	46%	35%	16%	17%	18%

Source: Fish value chain meso level survey, 2018

First, unsurprisingly for production zones, the ratio of rural to urban traders is about 2.2 overall. The ratio is highest in Argungu in the North, at 2.9, perhaps because this is a key cross-border trading point. However, if it is because it is cross-border hub, it is puzzling that it is dominated (far more than the other zones) by small urban wholesalers. Moreover, even urban traders are concentrated (around 60% of them) in Yauri, as a major inter-state hub as well as a local production zone.

Second, as with rural traders, urban traders rose by a ratio of 1.3 over the decade. Nearly all the growth was in Yauri, again. Third, the main shift in strata size composition was the sharp growth in the share of medium traders and the decline of small traders in Yauri, mirroring what we saw in rural traders except that there was a slight decline in the share of larger traders in Yauri.

The picture that emerges is that Yauri is a "super cluster" both of fishers, fish farms, and traders, with dominance in these in the state and the great majority of growth in them. But interestingly it does not include hatcheries or mills and either home-produces these or buys them from outside the state; we will not know the mix until we undertake the micro survey.

Table 7. Structural change among Urban Fish Retailers over 10 years

Zone	Urban retailers											
Zone	Total number			Small in total number			Medium in total number			Large in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	40	40	38	18%	18%	38%	24%	33%	38%	58%	49%	24%
Bunza	327	250	209	40%	28%	32%	35%	45%	40%	25%	27%	28%
Zuru	136	172	116	46%	27%	38%	18%	56%	45%	36%	17%	17%
Yauri	2095	1305	655	47%	41%	46%	32%	33%	35%	21%	26%	19%
All	2598	1767	1018	46%	37%	42%	31%	37%	37%	23%	26%	21%

Source: Fish value chain meso level survey, 2018

In Table 7, first, urban fish retailers multiplied much faster than fish traders (2.5 versus 1.3 ratio over the 10 years), and even faster than fish producers (2.5 versus 2.0). As we would need a micro study to know the volumes involved and where the fish come from to feed these cities, these differences at least suggest that fish traders are dealing in fish both from Kebbi State and from other states and imported fish as well.

Second, the dominance of Yauri grew quickly from 64% to 81% of urban retail traders over the period. Part of this is just because the other zone's urban retailers grew little (in Argungu and Zuru) or only 1.5 times, as in Bunza). But urban retailers in Yauri actually tripled. This implies something about the urban fish consumption and economies of Yauri, as it is probably only partly linked to the doubling of fish producers in the zone. It will take a micro study of the urban fish economy of the zones to understand what is driving this tripling. In itself it is not however odd, as this is the same sort of tripling in a decade that was found in off-farm actors in the fish sector in Bangladesh over the past decade as fish consumption soared and local supply chains grew (Hernandez et al. 2017).

Third, in the two zones in which urban retail numbers grew (Bunza and Yauri), there was little change in the size strata composition of retailers (compared with the concentration we see in rural traders).

In Table 8, first, rural fish retailers multiplied at the same rate as fish traders (1.3 ratio over the 10 years), and less fast that the 2.0 of fish producers. This could imply that rural fish retailing is supplied by local fish producer rather than outside the zone.

Second, recall that Yauri had grown to 81% of urban retail traders over the period; by sharp contrast, its share of rural retail is but 47%. This makes sense as the other zones have important rural populations beyond fish farming and there is no reason that rural retail for local consumption should be commensurate with fish production given that most of the latter is probably sent out of Yauri to other zones and states and countries.

Third, as with urban retail, there was little change in the size strata composition of retailers (compared with the concentration we see in rural traders). Given that most of the latter is probably sent out of Yauri to other zones and states and countries.

Table 9, interestingly, despite the large growth in the numbers of urban and rural wholesalers and urban retailers, to our surprise there has been almost no change in the numbers of physical markets and collection points. This coincides with the kind of thing one observes in the fish wholesale market in Abuja – a market built a decade ago that had a tripling of fish commerce actors and is now "bursting at the seams." These Kebbi results might similarly indicate strained infrastructure and that public and private investment are lagging the rapid increase in the sector. In this way Kebbi State differs sharply from the Bangladesh results where the government was quickly multiplying the number of rural wholesale markets over the period to economically accommodate the growth – a similar rapid growth as in Kebbi.

In Table 10, first, over the decade the total number of fish processors declined but with a modest swiveled J curve. The north actually had a small increase (1.2 ratio) of processors over the decade, while the south had a decline of about 10%.

Second, the share of Yauri in processors dropped from 66 to 56%, as Argungu's share increased.

Third, while we inventoried a wide set of processors (smokers, refrigerators, roasters, and dryers), by 2018 smokers 52% and fryers were 44%. Dryers, refrigerators, and roasters together only had 4%.

Fourth, within the category of fish fryers, and in the North where processors grew somewhat, the share of the large fryers fell by nearly half and small fryers nearly doubled in share. In a less pronounced way, the same trend occurred in the North with the fish smokers. While one explanation

for these shifts (heard anecdotally in the survey areas) is that many fish processors have shifted into rice farming, this requires further exploration at a micro level.

In Table 11, it may seem surprising that despite a 2.0 fold increase in fish producers, a 2.5 fold increase in fish retailers, and a 1.3 fold increase in traders, the number of vehicles has essentially stayed unchanged for a decade, even in Yauri! We require a micro study to explain this, but one possibility (that occurred in Bangladesh) is that the third party logistics (3PLS) services increased and there was no need for more ownership of dedicated vehicles by the actors. (We also found this in the maize trader sector.)

4. CONCLUSION

Despite challenges associated with fish production in Kebbi State, this study finds evidence of large increases in the number of fishers in the state over the past decade. Through a meso inventory of actors along the fish value chain we found that over the past 10 years there has been a 182% increase in fishers with the rate of growth fastest in Yauri (192%) in the South, and slowest in Bunza (171%) in the North. Even more strikingly, our results revealed a rate of growth in fish farmers that is faster than the number of fishers. The number of fish farmers across the four zones grew 200%, from 683 in 2008 to 1367 in 2018. This rate of growth of numbers of fish farmers is even greater than that of Bangladesh in 2004 to 2014, qualified as a "Quiet Revolution" in aquaculture in Bangladesh (Hernandez et al. 2018).

In Kebbi, Yauri appears to dominate in fish production and commerce. Consistent with historical patterns, the highest concentration of the state's fishers (consistently 45% over the last 10 years) is in Yauri. It also accounts for majority of the fish production through capture; about 70-75% of total volume. Yauri's pivotal role in Kebbi likely stems from its key location.

Besides having the huge highway (A1) going through it, Yauri serves as a confluence of farmers/fishers, water and traders. This triangle of key facilitators (infrastructure, water and fishing activity) in Yauri indicate its potential for leading Kebbi's fish subsector. It also provides insight to the factors necessary in Kebbi (or other states across Nigeria) to increase Nigeria's domestic fish supply to meet the rapidly expanding demand.

Table 8. Structural change by Rural Fish Retailers over 10 years

Zone	Rural retailers											
Zone	Total number			Small in total number			Medium in total number			Large in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	862	777	731	38%	38%	37%	33%	38%	37%	28%	23%	26%
Bunza	533	410	349	44%	45%	44%	31%	30%	31%	26%	26%	27%
Zuru	37	15	10	35%	67%	80%	24%	27%	20%	41%	6%	0%
Yauri	1364	1140	975	43%	44%	46%	36%	36%	36%	21%	20%	18%
All	2796	2342	2065	42%	42%	43%	34%	35%	35%	24%	23%	22%

Source: Fish value chain meso level survey, 2018

Table 9. Wholesale and Retail Markets

Zone	Total number			Farm Gate Market			Collection Point /Aggregate Market			Urban Wholesale Market			Rural Wholesale Market			Urban Retail Market			Rural Retail Market		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	51	51	51	45%	45%	45%	14%	14%	14%	2%	2%	2%	0%	0%	0%	0%	0%	0%	49%	49%	49%
Bunza	52	52	52	46%	46%	46%	27%	27%	27%	0%	0%	0%	0%	0%	0%	0%	0%	0%	19%	19%	19%
Zuru	20	20	20	70%	70%	70%	0%	0%	0%	5%	5%	5%	0%	0%	0%	0%	0%	0%	25%	25%	25%
Yauri	134	132	132	54%	54%	54%	25%	25%	25%	7%	8%	8%	5%	5%	5%	3%	3%	3%	6%	6%	5%
ALL	257	255	255	52%	52%	52%	21%	21%	21%	5%	5%	5%	2%	2%	3%	1%	1%	1%	19%	19%	18%

Source: Fish value chain meso

Table 10. Structural changes of fish processors in 10 years

Zone	Processors																	
	Total number			Fish Smokers Small in total number			Fish Smokers Medium in total number			Fish Smokers Large in total number			Fish Refrigerators Small in total number			Fish Refrigerators Medium in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	1123	857	801	15%	12%	12%	14%	15%	15%	12%	13%	15%	0%	0%	0%	0%	0%	0%
Bunza	1100	986	1068	9%	9%	8%	12%	10%	11%	10%	10%	11%	0%	1%	0%	0%	0%	0%
Zuru	302	197	133	22%	11%	9%	12%	9%	14%	13%	23%	18%	0%	0%	0%	0%	0%	0%
Yauri	3266	3399	3931	28%	27%	24%	18%	17%	17%	14%	16%	17%	1%	1%	1%	1%	1%	0%
All	5791	5439	5933	21%	21%	19%	16%	15%	15%	12%	14%	16%	1%	1%	1%	1%	1%	0%

	Fish Refrigerators Large in total number			Fish Roasters Small in total number			Fish Roasters Medium in total number			Fish Roasters Large in total number			Fish Sun-dryers Small in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
Bunza	3%	3%	1%	0%	0%	0%	0%	0%	0%	1%	1%	0%	1%	2%	1%
Zuru	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yauri	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	3%	2%
All	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%	2%

	Fish Sun-dryers Medium in total number			Fish Sun-dryers Large in total number			Fish Fryers Small in total number			Fish Fryers Medium in total number			Fish Fryers Large in total number		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	0%	0%	0%	0%	0%	0%	28%	24%	17%	14%	17%	12%	15%	16%	21%
Bunza	1%	2%	3%	0%	1%	4%	16%	14%	14%	21%	23%	25%	24%	25%	26%
Zuru	0%	0%	0%	0%	0%	0%	34%	40%	34%	15%	11%	16%	4%	6%	9%
Yauri	2%	2%	2%	1%	1%	1%	14%	13%	14%	10%	10%	11%	9%	9%	11%
All	1%	1%	2%	1%	1%	1%	18%	15%	14%	13%	14%	14%	13%	13%	15%

Source: Fish value chain meso level survey, 2018

Table 11. Transport Sector

Zone	Means of Transporting Fish																	
	Total number			Motor Cycles			Cars			Buses			Canter			Canoe/Boat		
	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008	2018	2013	2008
Argungu	312	335	399	58%	57%	55%	22%	19%	20%	3%	6%	6%	7%	6%	7%	10%	12%	13%
Bunza	488	637	538	48%	31%	41%	18%	15%	21%	5%	4%	6%	6%	5%	7%	23%	45%	25%
Zuru	25	17	21	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yauri	1083	1037	1042	44%	40%	41%	18%	15%	12%	2%	2%	1%	3%	2%	2%	33%	41%	44%
All	1908	2026	2000	48%	41%	45%	18%	15%	16%	3%	3%	3%	5%	4%	4%	26%	37%	32%

Source: Fish value chain meso level survey, 2018

ANNEX: FISH CLUSTERS IN THE STUDY AREA

Zone	Local Government Areas	Sampled Villages/Towns
Argungu	Argungu, Arewa, Augie, Dandi, Gwandu, Aliero & Jega	Argungu, Danbarke, Bubuche, TunganMaidawa, Gulma, Sauwa, Kangiwa, Bachaka, Bui, Yeldu, Falde, Augie, Mera, Dundaye, Illela, Bagaye, Bayawa, Kwaido, Yola, Zagi, Fana, Fingila, Kamba, Dolekaina, Bada, Lagwardi, Tari, YolaMaimiya, Kambaza, Gwandu, Malissa, Dodoru, Aliero, Sabiyel, RahinBauna/UnguwarLawal, Kashin Zama, Jega, Gindi, Basaura, Dangamaji, Gidan KajiJega
Bunza	Birnin Kebbi, Bunza, Kalgo, Maiyama & Suru	Kardi, Yamama, Harasawa, Gulumbe, Ambursa, Kola, Tarasa, Makera, BirninKebbi,NassarawaI&II, Zauro, Gwandangaji, Bunza, Tilli, Zogirma, Maidahimi, Raha, Kalgo, Maiyama, Mungadi, Anadarai, Aida, Sagwarada, DanyenGari, Mungadi, Sambawa, Suru, Tannikwara, Talata, Giro
Zuru	DankoWasagu, Fakai, Sakaba, & Zuru	Maga, Maikaho, Mashigi, Kastu, Yarkuka, Machika, Ribah, Mahuta, Kukum, DirinDaji, Doka, Zuru, Rikoto, Zango
Yauri	Bagudo, Koko Besse, Ngaski, Shanga, &Yauri	Tunga Maiboda, BakinWuya, Malawai, Lolo, Bagudo, Tuga, IllelaGeza, Buda, Gendani, Lolo Giris, YelwaBargu, Mai Zaga, Gausu, Kende, Sharadi Konguwai, Koko, Besse, Saminaji, Madallah, Jaderi, Tungan Dada, Tungan Babanta, Tungan Habibu, Zariya, Rahan Taro, Gargade, Boji, Wara, Utono, Ulera, Gungun Tagwaye, Kashin Jiki, Masamale II, Wawu, TungaBosa, Gungun Hoge, Tungan Leda, Toro, Sakace, Sawushi, TungaMangoro, Raha, Tsamiya, Nasarawa, Dugu, Gebbe, Korkoso, Kurmundi, Shabanda, Gebe, Tungan Zaure, Tunga Sani/Gumbi, Tungan Makera, Maishagali, Zamare, Yauri, YelwaYauri, Wadata Area, Tondi, UnguwarFada, GungunSarki, Bunzawa, Tondi Tsohowa

Source: Fish value chain meso level survey, 2018

Annex: Fish clusters in the study area

Zone	Local Government Areas	Sampled Villages/Towns
Argungu	Argungu, Arewa, Augie, Dandi, Gwandu, Aliero & Jega	Argungu, Danbarke, Bubuche, TunganMaidawa, Gulma, Sauwa, Kangiwa, Bachaka, Bui, Yeldu, Falde, Augie, Mera, Dundaye, Illela, Bagaye, Bayawa, Kwaido, Yola, Zagi, Fana, Fingila, Kamba, Dolekaina, Bada, Lagwardi, Tari, YolaMaimiya, Kambaza, Gwandu, Malissa, Dodoru, Aliero, Sabiyel, RahinBauna/UnguwarLawal, Kashin Zama, Jega, Gindi, Basaura, Dangamaji, Gidan KajiJega
Bunza	Birnin Kebbi, Bunza, Kalgo, Maiyama & Suru	Kardi, Yamama, Harasawa, Gulumbe, Ambursa, Kola, Tarasa, Makera, BirninKebbi,NassarawaI&II, Zauro, Gwandangaji, Bunza, Tilli, Zogirma, Maidahimi, Raha, Kalgo, Maiyama, Mungadi, Anadarai, Aida, Sagwarada, DanyenGari, Mungadi, Sambawa, Suru, Tannikwara, Talata, Giro
Zuru	DankoWasagu, Fakai, Sakaba, & Zuru	Maga, Maikaho, Mashigi, Kastu, Yarkuka, Machika, Ribah, Mahuta, Kukum, DirinDaji, Doka, Zuru, Rikoto, Zango
Yauri	Bagudo, Koko Besse, Ngaski, Shanga, &Yauri	Tunga Maiboda, BakinWuya, Malawai, Lolo, Bagudo, Tuga, IllelaGeza, Buda, Gendani, Lolo Giris, YelwaBargu, Mai Zaga, Gausu, Kende, Sharadi Konguwai, Koko, Besse, Saminaji, Madallah, Jaderi, Tungan Dada, Tungan Babanta, Tungan Habibu, Zariya, Rahan Taro, Gargade, Boji, Wara, Utono, Ulera, Gungun Tagwaye, Kashin Jiki, Masamale II, Wawu, TungaBosa, Gungun Hoge, Tungan Leda, Toro, Sakace, Sawushi, TungaMangoro, Raha, Tsamiya, Nasarawa, Dugu, Gebbe, Korkoso, Kurmundi, Shabanda, Gebe, Tungan Zaure, Tunga Sani/Gumbi, Tungan Makera, Maishagali, Zamare, Yauri, YelwaYauri, Wadata Area, Tondi, UnguwarFada, GungunSarki, Bunzawa, Tondi Tsohowa

Source: Fish value chain meso level survey, 2018