Nigeria Agricultural Policy Project

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

By

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1. INTRODUCTION

This study presents the results from a meso-inventory with a recall over 10 years of numbers of actors of different size strata in the fish value chain segments in Niger State, Northern Nigeria. It was conducted between March and July 2018. We explore the growth and changing structure of the fish value chain in the state. The 9 segments studied include hatcheries and feed mills (as inputs to the farmed fish segment), fish production (fish farmers and fishers), urban and rural wholesalers and retailers, and fish processors.

Niger state is named after the River Niger and is Nigeria's largest state. It is the home to two of the country's major hydroelectric power stations and several key lakes. Given the abundance of river and lake water and fish, fishing is a key economic activity that has been joined recently by an emerging aquaculture (fish farming) sector.

Beside its water and fish resources, Niger State is crossed by highways and dotted with urban centers, and in the midst of a web of domestic and international trade routes. To the west, it shares an international border with the Republic of Benin. To the North, it shares borders with Kebbi and Zamfara States; to the North and East it is bordered by Kaduna State. To the East it is bordered by the Federal Capital, Abuja. And to the South it is bordered by Kwara and Kogi States. Niger State is thus an important hub serving numerous states in the north as well as neighboring countries in the West African sub region. Being home to Suleja (a dynamic trading center close to Abuja, Niger State occupies a strategic commercial location in Nigeria.

2. METHOD

 To select our study zones, a field-based "rapid reconnaissance" was conducted to identify the major clusters of fish production (fish farmers and fishers). This was used to update a base list of actors generated via a stakeholder consultation and 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 Niger State. This led to key production zones or clusters being identified in the state.

To arrive at the sample for the study, we adopted the method of sampling implemented by Hernandez *et al.* (2018) in their study on the "quiet revolution" in the aquaculture value chain in Bangladesh. First, a listing of actors in each segment of the fish value chain was undertaken zone by zone, then local government by local government, then village by village. We listed the numbers of actors by size stratum for each of 10 segments of the fish value chain: hatcheries and feed mills (as inputs to fish farming), fish farms, fishers, rural and urban fish wholesalers, rural and urban fish retailers, fish processors, and fish transporters. Then we used a "snowballing" technique to identify new locations missed in the initial classification/listing; typically new areas of activity that had recently developed in the subsector.
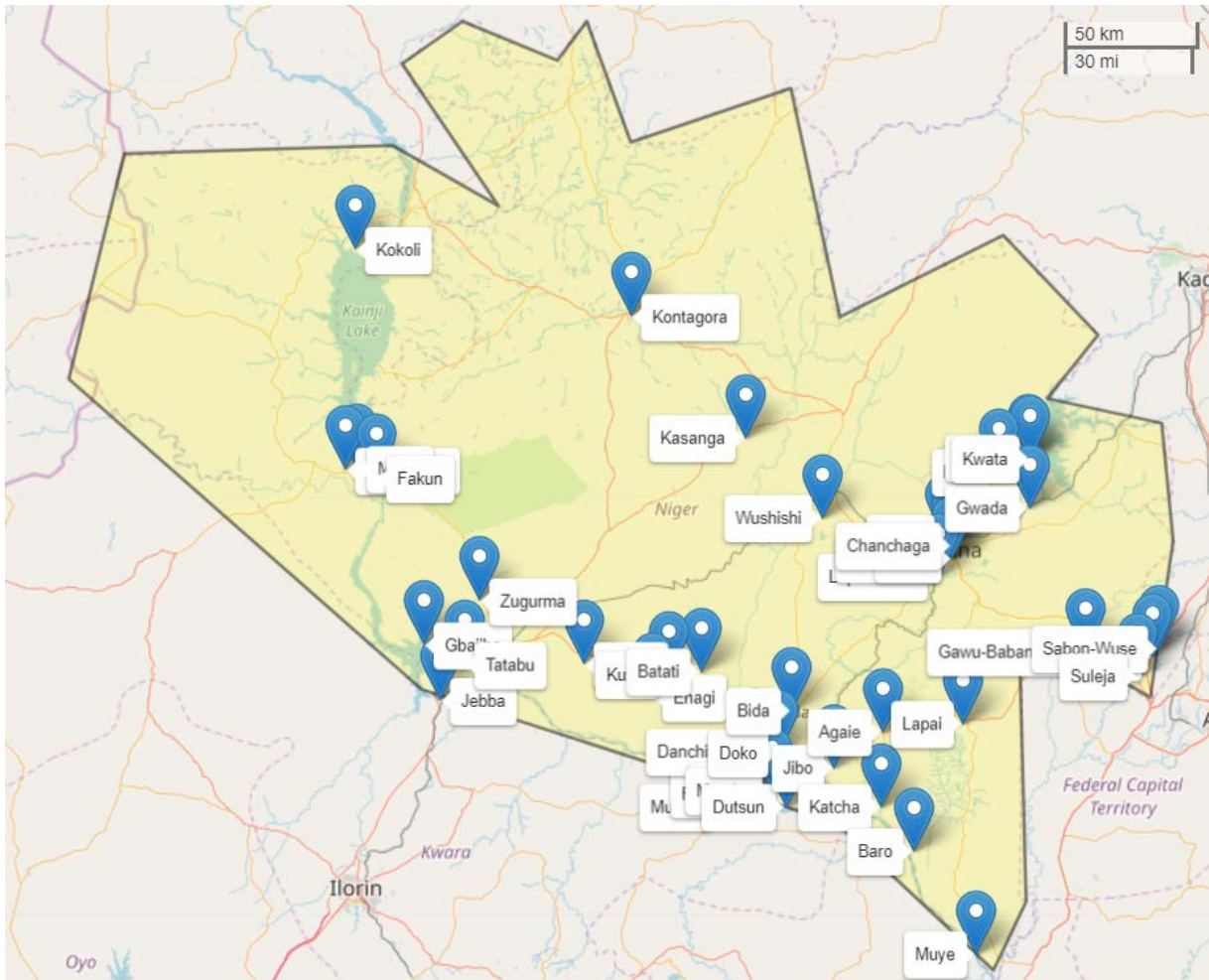
Fig. 1: Map of Nigeria showing the study area and the names of the chosen locations
Source: Pebesma (2018),

The areas sampled were Mokwa, Bida, Lapai, Bosso, Shiroro, Katcha, Kontagora, Lavun, Borgu, Edati, Agaie, Gbako, Chanchanga, Suleja, Minna, New Bussa and Niger-Kogi boundary (Fig. 1). In each area we identified 39 key production local clusters which were then grouped for analysis purposes into seven production zones as presented in Table 1. Each zone includes selection of most or all of the segments of the urban and rural parts of the fish value chain (for both captured fish from fishers and fish from fish farmers).

The list of actors interviewed were fish farmers, fishers, hatchery owners, feed mill owners, processors, rural wholesalers, rural retailers, urban wholesalers, urban retailers, and assembly point/aggregating markets of fish. 535 respondents were interviewed as key informants.

Table 1-8 show for Niger State structural change represented by numbers of different actors and shares of the size strata in the total number. We discuss this actor by actor. We start with fish farmers and fishers as a reference point to understand the relative sizes and patterns of the inputs and post-farm segments.

Table 1. Fish farm segment in Niger State

| % | Year | Zone | | | | | | | TOTAL |
		Bida	Capital City	Kontagora	Lapai	Mokwa	New Bussa	Shiroro	
Total number	2008	15	0	1	8	0	5	21	50
	2013	35	0	5	15	0	50	19	124
	2018	101	63	5	10	0	500	2	681
% of small in total number	2008	60	0	0	25	0	60	71	
	2013	69	0	40	20	0	18	63	
	2018	36	0	40	20	0	1	0	
% of medium in total number	2008	40	0	0	38	0	40	19	
	2013	31	0	40	33	0	32	32	
	2018	59	21	40	40	0	15	100	
% of large in total number	2008	0	0	100	37	0	0	5	
	2013	0	0	20	33	0	38	0	
	2018	5	59	20	30	0	54	0	
% of extra-large in total number	2008	0	0	0	0	0	0	5	
	2013	0	0	0	14	0	12	5	
	2018	0	20	0	10	0	30	0	

Source: Fish Value Chain *meso* level survey, 2018

First, while stakeholder meetings emphasized the challenges of the aquaculture sector, the simple facts in table 1 tell us that it is growing very substantially, nearly 14 times more in 2018 than 2008 (albeit starting from a low base of 50 in 2008) and even faster than the number of fishers (who multiplied by a factor of 2.3 over the decade). By 2018, fishers still dominate with 99% of fish producers; fish farmers only form 1% of fish farmers. But still the spectacular take-off just recently of fish farming shows a rate of growth of numbers of farmers 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) in fish farming (and a spate of other species from capture fishing as one would expect).

Third, unlike in Kebbi State where the same zone that dominates in fishing also dominates in fish farming (because of the web of rivers and wetlands serving both), in Niger State we find that while Mokwa by far dominates fishing (with 90% of all fishers in the state), New Bussa far dominates fish farming with 73% of fish farmers in the state. In 2013, just five years earlier, New Bussa only had 40% of the fish farms in the state, so its dominance is growing fast. Bida has another 15% in 2018 (28% in 2013) so the two zones make up 88% of the aquaculture in the state in 2018.

But below we note that New Bussa went from small farm dominated to large farm dominated in the decade, and Bida went to medium farm dominated – while the other zones (except the capital city) had smaller farms. Thus 88% is an underestimate of the share of these two zones in the total farmed-fish quantity in the state – it might be nearer to 95 or 98%.

Note that at the "take off" of fish farming, circa 2008, the two zones only had 40% of the fish farms; Shiroro itself had the same share. Then these two zones outstripped all the others. It appears

that their advantage is the combination of market (roads and town) and water. New Bussa and Bida are towns near major roads, and with excellent access to water – thus good access to markets and good access to resources, both obviously crucial to fish farming in the state. In addition, in New Bussa is headquartered the National Institute for Freshwater Fisheries Research – NIFFR. The Institute has extension programs to fish farmers in New Bussa and Bida (Ifejika and Oladosu, 2013).

Fourth, it is striking that the share of small farmers in the total in New Bussa plummeted from 60 to 1% over the decade! By contrast, that share in Bida rose from 60 to 36% over the decade. Interestingly, the share of medium farmers also plummeted over the decade, from 40 to 15% in New Bussa – but rose from 40 to 59% in Bida. Stunningly we found that the share of large farms rose from 0 to 54%, and extra-large, from 0 to 30% over the decade in New Bussa. As these two zones have 88% of the fish farms in the state, this implies that the average fish farm size jumped extremely fast over just one decade.

Table 2: Fishers % of small, medium and large in total number

%	Year	Zone							
		Bida	**Capital City**	**Kontagora**	**Lapai**	**Mokwa**	**New Bussa**	**Shiroro**	**TOTAL**
Total number	2008	1675	72	0	282	20,125	1000	450	23,604
	2013	1999	56	0	330	35,095	1500	490	39,470
	2018	2625	44	0	355	50,080	2000	505	55,609
% of small in total number	2008	0	10	0	4	0	0	17	
	2013	0	16	0	4	0	0	29	
	2018	0	16	0	5	0	0	31	
% of medium in total number	2008	0	25	0	15	0	0	28	
	2013	0	27	0	19	0	0	20	
	2018	0	30	0	22	0	0	30	
% of large in total number	2008	100	65	0	81	100	100	55	
	2013	100	57	0	77	100	100	51	
	2018	100	54	0	73	100	100	39	

Source: Fish Value Chain *meso* level survey, 2018

Table 2 shows results for capture fisheries in Niger State. Several points stand out.

First, despite our hearing in the stakeholder meetings of the demise of capture fisheries in the North of Nigeria with issues of water and overfishing, in fact we report large increases in fishers over the decade. In Niger State the number multiplied 2.3 times over a mere 10 years. That ratio was 2.5 in Mokwa, by far the lead fishers concentration in the state. Niger State is extremely well endowed with fishery resources given the presence of the mighty rivers Niger and Kaduna. Bida and New Bussa together nearly had a doubling of fishers, but are minor in share compared with Mokwa discussed below.

Second, there is a high concentration of the state's fishers in Mokwa which has 91% of the fishers in the state. The zone of Mokwa contains a large number of rural fishing communities as well as

a near-highway commercial center in the rural area and a town with 200-300,000 population. It borders the Niger River from Lake Jebba in the west beyond the confluence of the Kaduna River in the east. The city and many of the commercial points of rural fisheries are on or near the highway. The largest concentration of fishers and traders are in Gbajibo which is near (about 15 kilometers) from the Lagos-Ilorin-Mokwa-Bida highway. It seems to be the confluence of access to rivers and lakes, highway, and a major commercial center that produce its dominance. Its number of fishers is very large, growing from 20,000 to 50,000 in only one decade!

Third, it is very striking that in Mokwa and in the two lesser centers of capture fisheries, Bida and New Bussa, 100% of the fishers are classed as large scale, hence commercial rather than small "livelihoods" oriented fishers. That contrasts with the small fishing zones that are a mix of different size strata and thus presumably of fishers focused on part time or full time livelihood category of fishing.

Table 3: Hatcheries % of small, medium and large in total number

| % | Year | Zone | | | | | | | TOTAL |
		Bida	Capital City	Kontagora	Lapai	Mokwa	New Bussa	Shiroro	
Total number	2008	0	0	0	0	0	10	0	**10**
	2013	0	1	0	1	0	50	0	**52**
	2018	0	2	0	1	0	20	0	**23**
% of small in total number	2008	0	0	0	0	0	40	0	
	2013	0	100	0	100	0	38	0	
	2018	0	50	0	100	0	25	0	
% of medium in total number	2008	0	0	0	0	0	30	0	
	2013	0	0	0	0	0	42	0	
	2018	0	50	0	0	0	35	0	
% of large in total number	2008	0	0	0	0	0	30	0	
	2013	0	0	0	0	0	20	0	
	2018	0	0	0	0	0	40	0	

Source: Fish Value Chain *meso* level survey, 2018

Table 3 shows structural change in the hatcheries segment. Several points are salient.

The number of hatcheries followed a sharp inverted-U path over the past decade in the state. As nearly the only hatcheries were in New Bussa that was the pattern in that zone. In 2008 there were only 10 hatcheries; of which 40% were small, 30 medium, and 30% large. After 5 years there were 50, a little shifted toward being medium and fewer large. But then by the end of a decade there are only 20 in New Bussa (of 23 in the state), but now 40% of them are large scale. Thus probably the overall volume more than doubled, perhaps by a factor of 2.5 or 3 times. Recall from above that the number of fish farms increased 14 fold, and the average farm size increased substantially. Conservatively then we could say that the volume of fish farmed increased say 20 or 25 times, some 10 times faster than the output of hatcheries.

The above rough calculations do not necessarily imply that hatchery output was inadequate for the farms in the state, however. The ratio of farms to hatcheries is 681/23, or 30 farms per hatchery. It is possible that a large hatchery could supply fingerlings to even 30 large farms. To the extent they cannot, it is possible that farms are producing their own fingerlings from purchased roe, or gathering them from rivers, or buying them from active fingerling markets such as one we

observed in Abuja where the respondents noted they are selling to traders and farms in Niger State and Kebbi States, inter alia.

Finally, the concentration of almost all the state's hatcheries in New Bussa may be because of the confluence there of water access, markets, and a highway, as well as the National Institute of fisheries with its extension services.

Table 4. Feed mills % of small, medium and large in total number

%	Year	Zone							TOTAL
		Bida	Capital City	Kontagora	Lapai	Mokwa	New Bussa	Shiroro	
Total number	2008	0	1	0	0	0	15	0	**16**
	2013	1	1	0	1	0	40	0	**43**
	2018	1	5	0	1	0	70	0	**77**
% of small in total number	2008	0	1	0	0	0	100	0	
	2013	100	1	0	100	0	25	0	
	2018	100	40	0	100	0	7	0	
% of medium in total number	2008	0	0	0	0	0	0	0	
	2013	0	0	0	0	0	75	0	
	2018	0	60	0	0	0	64	0	
% of large in total number	2008	0	0	0	0	0	0	0	
	2013	0	0	0	0	0	0	0	
	2018	0	0	0	0	0	29	0	

Source: Fish Value Chain *meso* level survey, 2018

Table 4 shows structural change in the feed mill segment. Several points are salient.

First, the patterns for feed mills are similar to those for hatcheries, except that there appears to be somewhat more of a supply-demand match between the 77 local mills (nearly all of which are medium or large) and the fact that there are nearly 700 fish farms in the state and about half are large/extra-large. There may be some shortfall which presumably is met by farmers marking their own feed from ingredients or buying packaged feed from other states.

Second, as with farms, fishers, and hatcheries, New Bussa greatly dominates feed supply, with 90% of the mills during the decade, and because that zone also averages much bigger mills than the other zones, probably 95% of Niger State feed (at least) comes from New Bussa.

Third, interestingly, small mills quickly disappeared from New Bussa over the decade, replaced mid-decade by medium mills and end decade by large mills. This is a similar trend to what one finds in other regions, such as in the development path of aquaculture in Bangladesh.

Fourth, it appears likely that the feed mills in New Bussa sell to other zones in the state (just as traders from other states probably bring feed into all the zones).

Table 5. Fish Markets

%	Year	Zone								TOTAL
		Bida	Capital-City	Kontagora	Lapai	Mokwa	New Bussa	Shiroro	Suleja	
Total number	2008	18	4	4	8	8	5	6	8	61
	2013	18	4	5	8	8	7	6	11	65
	2018	18	4	5	8	8	7	6	11	65
% of Farmgate Market	2008	17	0	0	0	13	40	16	0	
	2013	17	0	0	0	13	29	16	0	
	2018	17	0	0	0	13	29	16	0	
% of Aggregating Market	2008	11	0	0	0	13	20	17	0	
	2013	11	0	0	0	13	29	17	0	
	2018	11	0	0	0	13	29	17	0	
% of Urban Wholesale Market	2008	6	50	50	25	0	0	17	0	
	2013	6	50	40	25	0	14	17	0	
	2018	6	50	40	25	0	14	17	0	
% of Rural Wholesale Market	2008	39	0	0	25	13	20	17	0	
	2013	39	0	0	25	13	14	17	0	
	2018	39	0	0	25	13	14	17	0	
% of Urban Retail Market	2008	6	50	50	25	0	20	17	25	
	2013	6	50	60	25	0	14	17	18	
	2018	6	50	60	25	0	14	17	18	
% of Rural retail markets	2008	21	0	0	25	61	0	16	75	
	2013	21	0	0	25	61	0	16	82	
	2018	21	0	0	25	61	0	16	82	

Source: Fish Value Chain *meso* level survey, 2018

Table 6. Fish Transportation

%	Year	Zone								TOTAL
		Bida	Capital-City	Kontagora	Lapai	Mokwa	New Bussa	Shiroro	Suleja	
Total number	2008	164	0	18	208	294	108	78	20	890

	Year									
	2013	242	0	35	313	431	171	97	23	1312
	2018	338	0	34	426	557	220	125	28	1728
% of Motorcycle	2008	18	0	0	10	3	0	23	0	
	2013	18	0	0	10	3	0	21	0	
	2018	18	0	0	9	2	0	20	0	
% of Cars used	2008	20	0	61	25	16	25	45	15	
	2013	19	0	54	29	21	26	48	13	
	2018	20	0	47	29	22	26	44	14	
% of Urban Buses used	2008	13	0	39	14	21	2	32	40	
	2013	15	0	46	18	22	2	31	52	
	2018	16	0	53	19	24	2	36	50	
% of Canter used	2008	6	0	0	6	11	21	0	20	
	2013	9	0	0	8	12	19	0	22	
	2018	9	0	0	11	14	19	0	25	
% of Vehicle 911 used	2008	0	0	0	0	0	0	0	0	
	2013	0	0	0	0	0	0	0	0	
	2018	0	0	0	0	0	0	0	0	
% of 3/4 Trailer used	2008	0	0	0	0	0	2	0	0	
	2013	0	0	0	0	0	2	0	0	
	2018	0	0	0	0	0	1	0	0	
% of Trailer used	2008	0	0	0	0	0	1	0	15	
	2013	0	0	0	0	0	4	0	13	
	2018	0	0	0	0	0	5	0	11	
% of Canoe/boat used	2008	43	0	0	46	48	56	0	0	
	2013	39	0	0	36	41	47	0	0	
	2018	36	0	0	32	39	45	0	0	

Source: Fish Value Chain *meso* level survey, 2018

The most striking finding in the results concerning the number of markets (Table 5) is that despite the large increase in fishers and fish farms in the past decade, the number of markets stayed constant at around 60! This is a similar result to what we found in Kebbi State, and the opposite of the rapid growth in public markets at wholesale and retail market that was found accompanying the fish farming boom in Bangladesh (Hernandez *et al.* 2018). Either traders are operating more off-market, or the density and area of the average market is increasing – perhaps with an increase in congestion and strain on the extant facilities.

Less surprising is that the share of rural aggregating markets in total markets tends to be correlated with the share of the zone in production of fish (fishing or farming).

The most striking finding about fish transport vehicles (table 6) is that the growth in their numbers roughly tracked the growth in fish producers. In Kebbi State we found vehicle numbers lagged fish producers' growth implying an increase in vehicle size or at least load sizes or frequency.

There was also some shifts in composition of the vehicle set. The canoe share dipped and the bus share rose.

Several findings are salient with respect to fish processors (see table 7).

First, the number of processors rose 1.3 fold in the decade while the number of fish producers increased by a factor of 2.3. This does not mean volumes decreased. Rather, we see in the main categories (smokers, fryers, roasters) that the share of large-scale enterprises increased in most zones.

Second, the distribution of fish processors closely tracks the fish production area – Mokwa, New Bussa, and Bida, for about 90% of the fish producers and processors.

Third, there is a strong correlation between presence of smokers and the three main production zones (fish and farming), and frying and roasting and the zones that are more urban operations instead of fish production. This makes sense as smoking prepares large volumes of fish for long distance shipment, while roasting and frying are for immediate consumption by clientele.

Table 7. Fish processors

Category	Share	Year	Bida	Capital-city	Kontagora	Lapai	Mokwa	New bussa	Shiroro	Suleja	TOTAL
Total number		2008	160	15	20	127	1658	64	38	29	**2111**
		2013	190	25	21	141	1790	52	45	35	**2299**
		2018	240	36	24	167	2225	75	57	36	**2860**
Share of Smokers in the total number	% of small	2008	53	6	0	29	29	47	0	21	
		2013	30	12	0	20	29	27	0	14	
		2018	14	11	0	25	26	33	0	14	
	% of medium	2008	31	0	0	32	34	42	0	14	
		2013	33	4	0	37	33	42	0	17	
		2018	42	8	0	42	34	37	0	14	
	% of large	2008	16	0	0	39	37	8	0	10	
		2013	37	0	0	43	38	25	0	17	
		2018	46	3	0	33	40	27	0	19	
Share of Fryers in the total number	% of small	2008	0	27	25	0	0	0	26	17	
		2013	0	8	24	0	0	0	16	9	
		2018	0	8	25	0	0	0	4	6	
	% of medium	2008	0	13	20	0	0	0	24	14	
		2013	0	20	28	0	0	0	31	11	
		2018	0	17	25	0	0	0	28	14	
	% of large	2008	0	7	10	0	0	0	8	7	
		2013	0	12	14	0	0	0	36	14	
		2018	0	11	20	0	0	0	30	17	
Share of Sun driers in the total number	% of small	2008	0	0	0	0	0	0	0	0	
		2013	0	0	0	0	0	0	0	0	
		2018	0	0	0	0	0	0	0	0	
	% of medium	2008	0	0	0	0	0	0	0	0	
		2013	0	0	0	0	0	0	0	0	
		2018	0	0	0	0	0	0	0	0	
	% of large	2008	0	0	0	0	0	0	0	0	
		2013	0	0	0	0	0	0	0	0	
		2018	0	0	0	0	0	0	0	0	

		2008	0	0	0	0	0	0	0	7	
	% of small	2013	0	0	0	0	0	0	0	0	
		2018	0	0	0	0	0	0	0	0	
		2008	0	0	0	0	0	0	0	7	
Share of Refrigerator in the total number	% of medium	2013	0	0	0	0	0	0	0	9	
		2018	0	0	0	0	0	0	0	6	
		2008	0	20	45	0	0	3	0	3	
	% of large	2013	0	24	33	0	0	6	0	9	
		2018	0	22	28	0	0	3	0	11	
		2008	0	7	0	0	0	0	18	0	
	% of small	2013	0	0	0	0	0	0	13	0	
		2018	0	3	0	0	0	0	5	0	
		2008	0	13	0	0	0	0	13	0	
Share of Roasters in the total number	% of medium	2013	0	8	0	0	0	0	16	0	
		2018	0	6	0	0	0	0	16	0	
		2008	0	7	0	0	0	0	11	0	
	% of large	2013	0	12	0	0	0	0	11	0	
		2018	0	11	0	0	0	0	18	0	

Source: Fish Value Chain *meso* level survey, 2018

3. CONCLUSIONS

We identified 7 main zones of fish production (fishing and/or fish farming) in Niger State, plus Suleja which is a fish trading point but not a main production point. The essence of the findings were as follows.

First, while stakeholder meetings emphasized the challenges facing fish farming, we found that in certain areas of the state fish farming grew spectacularly in a short time – overall 14-fold in the decade ending in 2018. These farmers still form but 1% of the fish producers in the state, but that does not take away from the presence of a "quiet revolution" in fish farming emerging and in its main zones of New Busa and Bida, looking much like success stories such as Bangladesh. These areas have good water access, towns, and highway access, key ingredients. Differing from Bangladesh however is the fact that the share of small farmers in the development started large and ended small, with the rapid rise of medium and large fish farmers.

Second, we also heard much of the challenges of fishing in the state. But our study found that in the Mokwa zone, where 91% of the fishers are concentrated in the state, a zone laced with tributaries and wetlands emanating from the River Niger, the fishers population has soared by a factor of 2.5 times in just 10 years, from 20,000 to 50,000! We found the fishers are also classed as commercial, as relatively large scale. This is certainly one of the main clusters of fresh water fishing in Africa and even the world.

Third, the input sector feeding fish farming is still modest in the state. Hatcheries have risen, but still seem limited in numbers, and feed mills even more so, although there is fast growth of mills in New Bussa. The overall picture is of farms making their own inputs or buying from outside the state. But this is common in Asian aquaculture boom countries like Bangladesh as well. There tends to be intra-country commerce in feed and fingerlings and some specialization over space. There is no reason for a state to be self-sufficient in fish farming inputs.

Fourth, the sticking point that differs so much from Bangladesh where the government has invested important funds in building rural and urban wholesale markets for fish, in Niger State for a decade the number is stuck at 60 markets. Yet the number of transport vehicles doubled along with fish producers. These are bursting at the seams and overwhelmed. There is an obvious market infrastructure constraint.

Fifth, the growth of fish processors lagged by about half the growth of fish producers. But that does not mean that volumes dropped. Rather we found that the share of large-scale processors sharply increased: there is concentration, which is predictable given this is a cross-state tradeable and there appears to be competition.

The policy implications are several, and we confine them to just what the numbers here tell us, and avoid hearsay and anecdotes and hypotheses beyond our hard facts.

On the one hand, where there is water, and a border or city market to facilitate commerce, the government best invest in highways to provide market outlets for the kinds of booms in fish farming and fishing we have observed in Niger State. These were not state or NGO programs, but private sector investments that sought markets and grew.

On the other hand, where Niger State matches success story places like Bangladesh in water access, and apparently also in entrepreneurial spirits of the people, it lags on wholesale and retail markets investments by government. Bangladesh government facilitated growth of the fish sector by making sure to keep pace with private actors by matching them with increasing numbers and size of wholesale and retail markets.

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