Output 1:
Future Fish Supply and Demand in Nigeria

Chin Yee Chan, Long Chu, Nhuong Tran, Kai Ching Cheong

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Agenda	
9:00	Opening remarks and participants introduction
9:10	Fish foresight modeling in Nigeria (Chin Yee)
9:30	Review of Nigeria data template for data estimates(Bashir & Olungunju) • Aquaculture, capture fisheries, domestic & imported consumption, export
10:30-11:00	*Coffee Break*
11:00	Review of Nigeria data template for estimates (Flora & Bernadette) • Aquaculture, capture fisheries, domestic & imported consumption, export
12:00	Review of Nigeria data template for estimates (Govinda) • Large scale/commercial Aquaculture, domestic & imported consumption, export
12:30	Review of Nigeria data template for data estimates (Uwheraka) • domestic & imported consumption, export
1:00-2:00	*Lunch*
2:00-3:00	Summary of data gaps and estimate (Chin Yee)
3:00-3:30	*Coffee Break*
3:30	Scenario development (Nhuong & Chin Yee)
5:00	Workshop adjourned for the day

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Aquaculture: increasing income, diversifying diets, and empowering women in Bangladesh and Nigeria

- First **BMGF** investment in aquaculture and fish
- Beginning – January 2019
- 50 months in Bangladesh
- 18 months in Nigeria – Phase I
- 32 months in Nigeria – Phase II

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Output 1: Nigeria future fish supply & demand

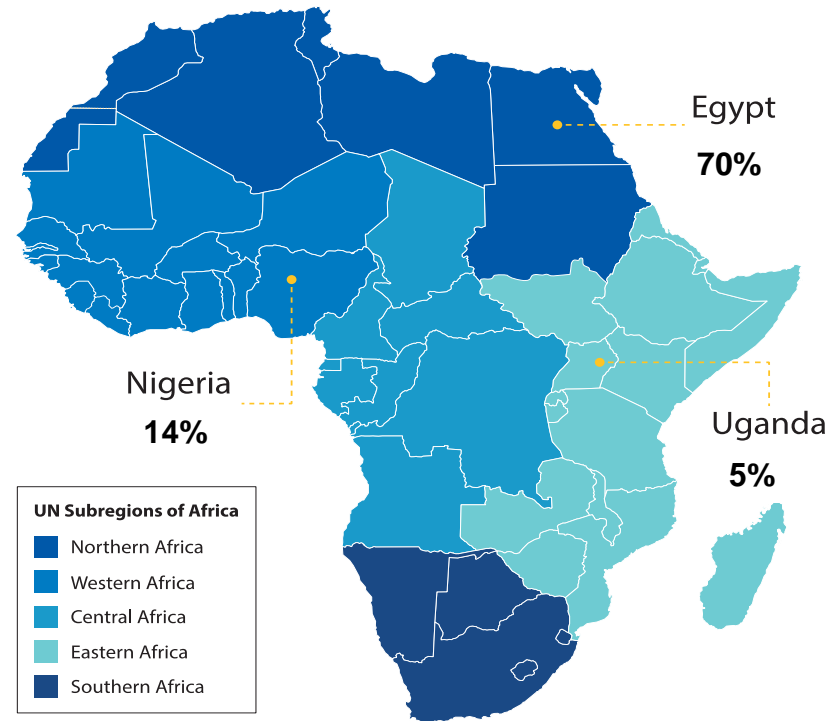| Intermediate Outcome	Output 1
Future macro level fish market demand and supply trends in Nigeria are better understood	Results of an analysis of Nigeria fish demand, supply and market trends reported.

Draft Nigeria model workplan

No	Activities	2019											
		Q1			Q2			Q3			Q4		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Design Workplan	▓											
2	Review Data		▓	▓									
3	Specify Model			▓									
4	Collect Data				▓	▓							
5	Verify Data					▓							
6	Develop Model					▓	▓						
7	Stakeholder workshop						▓						
8	Develop Scenario							▓					
9	Data Analysis								▓				
11	Validate Result									▓			
12	Draft Manuscript										▓	▓	
13	Review Manuscript												▓
14	Finalize Manuscript												▓

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Why are fish important to Nigeria?

Why fish is important in Nigeria

- **Largest aquaculture** producer in SSA (64% catfish ; 10% Carp; 8% Tilapia)

- **Largest catfish** producer in the continent

- Capture fisheries continue to dominate at **70%**

Egypt
70%

Nigeria
14%

Uganda
5%

UN Subregions of Africa
- Northern Africa
- Western Africa
- Central Africa
- Eastern Africa
- Southern Africa

Source: FishStatJ 2019

Why fish is important in Nigeria

- **Largest population** in Africa (191 million), projected to **double** and be the **third** most populous country by 2050
- Nearly **half** of population lives below poverty line (<US$1.90 a day)

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Why fish is important in Nigeria

- Fish demand **largely surpass** domestic fish production
- **Largest** fish consumer in Africa
- Fish accounted **43%** total animal protein in their diet
- Per capita fish consumption **13.5 kg/year**
- **Fish supply deficit: ~half** fish supply are imported (~1 million tons)

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Key Research Questions

1. How do **capture fisheries** and **aquaculture** in Nigeria respond to the increasing fish demand in the future, considering complex interactions of domestic supply, demand, trade and imports?

2. What are the **driving factors** that will influence future fish supply, demand and trade?

3. What are the impacts of fluctuating (especially increasing) **input** costs, (feed, seed, electricity, labour, etc.) on aquaculture production in Nigeria?

4. What is the future impact of **climate change** on aquaculture and capture fisheries production by 2050?

5. How future fish demand and supply will influence future fish markets and what are the **investment options** and strategies that could improve/increase fish supply and availability to increase the fish sector contribution of fish to Nigerian food and nutrition security?

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Methodology

Fish Foresight Modeling Approach

Global and regional level
(integrate fish into agriculture foresight modeling analysis)

- International Model for Policy Analysis of Agriculture Commodities and Trade (IMPACT)
- AgLINK-COSIMO model (OECD/FAO)
- Global Biosphere Management Model (GLOBIOM)

Country level
- AsiaFish model
- Fish sector model
  - Simple simulation in Excel

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Simple simulation in Excel

Unit	thousand tons	thousand tons	thousand tons		thousand tons	thousand tons	thousand tons
Nigeria	**Capture fisheries**	**Aquaculture**	**Import**	**.==.**	**Domestic consumptio**	**Export**	**Balance**
2013	721.4	278.7	1,413.6		2,316.8	96.8	0.0
2014	759.8	313.2	1,413.6		2,382.2	112.3	-7.9
2015	710.3	316.7	1,413.6		2,446.0	130.3	-135.6
2016	734.7	306.8	1,413.6		2,510.9	151.2	-206.9
2017	916.3	296.2	1,413.6		2,577.0	175.3	-126.2
2018	967.6	335.6	1,413.6		2,646.5	203.4	-133.2
2019	1,021.8	380.2	1,413.6		2,718.0	235.9	-138.3
2020	1,079.0	430.8	1,413.6		2,791.4	273.7	-141.7

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Data requirement Nigeria model-1

- Production/harvest of fish by **fish type** and **production system** (category; e.g. aquaculture, capture). Any two of the following for each fish group: quantity (kg or tons), producer price, value (quantity x producer price)

- **Inputs** used in production of fish; by input (e.g. feeds, seeds, labor, etc) and environment (category; e.g. aquaculture, capture). Any two of the following for each fish group: quantity (kg or tons), producer price, value (quantity x producer price)

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Data requirement Nigeria model-2

- Household **consumption** of fish by fish group, *region and/or income group. Any two of the following for each fish group, region (urban/rural)*: quantity (kg or tons), consumer price, value (quantity x consumer price).

- **Exports** of fish by fish group. Any two of the following for each fish group: quantity (kg or tons), consumer price, value (quantity x consumer price).

- **Imports** of fish by fish group. Any two of the following for each fish group: quantity (kg or tons), consumer price, value (quantity x consumer price).

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Data requirement-other data

- Population of persons by region and total (heads)

- Consumer price index: overall, food, non-food

- *Income by region and/or income group*

Other Parameter
- Search more recent estimates of consumption, production and trade **elasticities** in Nigeria/neighbouring countries.

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Nigeria Model Structure

Seven Fish Group

1. Catfish
2. Tilapia
3. Carps
4. Nile perch and snakeheads
5. Clupeids
6. shrimps and prawns
7. Others

Each of these seven fish groups can be produced with **two** main **production environment**
1. Aquaculture
2. Capture fisheries

Nigeria Model Structure

Aquaculture

1. Commercial/large scale aquaculture
2. Small scale aquaculture

Input use
1. Feed
2. Seed
3. Electricity
4. Labour
5. Other

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Nigeria Model Structure

Capture fisheries
1. artisanal coastal fishing
2. artisanal inland fishing
3. industrial coastal trawlers

Input use
1. Fuel
2. Labour
3. Other

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Past key findings in Africa, Zambia, Egypt

Foresight studies in Africa
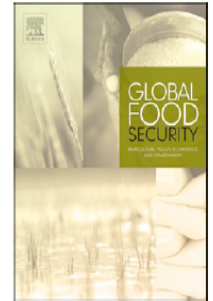
Prospects and challenges of fish for food security in Africa

Chin Yee Chan[a,*], Nhuong Tran[a], Shanali Pethiyagoda[a], Charles C. Crissman[c,1], Timothy B. Sulser[b], Michael J. Phillips[a]

[a] WorldFish, Jalan Batu Maung, Batu Maung, 11960 Penang, Malaysia
[b] International Food Policy Research Institute, 1202 I St, NW, Washington, DC 20005-3915, USA
[c] Malaysia

Africa stakeholder consultation workshop

Africa Aquaculture Research and Training Center, Abassa, Egypt

Participants: Egypt, Ghana, Kenya, Nigeria, South Africa, Tanzania, Zambia

Alternative scenarios justification

The three alternative scenarios address the key challenges observed in Africa's fish sector

1. fish supply deficit
2. low per capita fish consumption
3. low contribution of aquaculture to total fish output in Sub-Saharan Africa
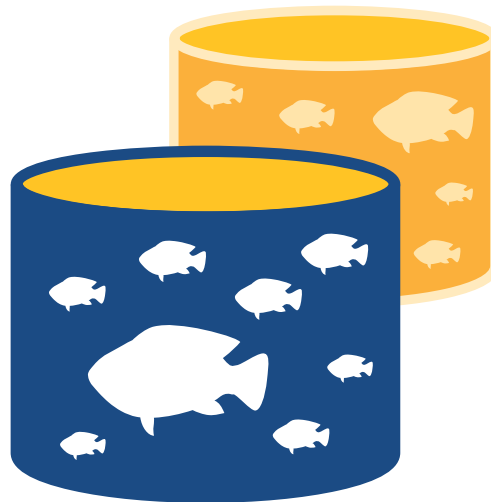
Scenarios description

Scenarios	Description
Business-as-usual **(BAU)**	Baseline reflect historical trends
High aquaculture growth **(HiAq)**	Substantially increased investment in the aquaculture industry continent-wide Selected countries - Egypt, Nigeria, Uganda, Ghana, Zambia. Species are Tilapia, *Pangasius* and other catfish, and Mullet
High aquaculture and GDP growth **(HiAqGDP)**	Aquaculture growth rates of HiAq plus the impact of increased income to reflect a medium-scale scenario of GDP growth in Africa of 4.8% per year
High Tilapia aquaculture growth **(HiTilapia)**	All African countries currently engaged in tilapia aquaculture will achieve the productivity of Egypt

Prospects and challenges of fish for food security in Africa
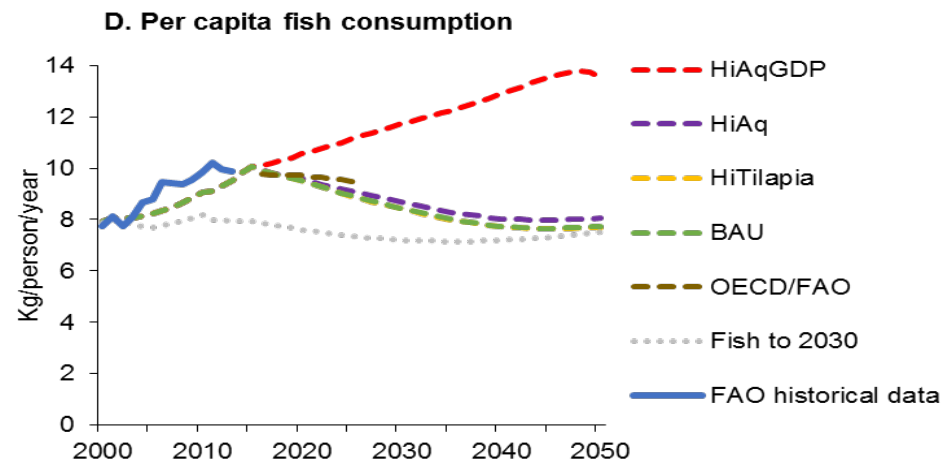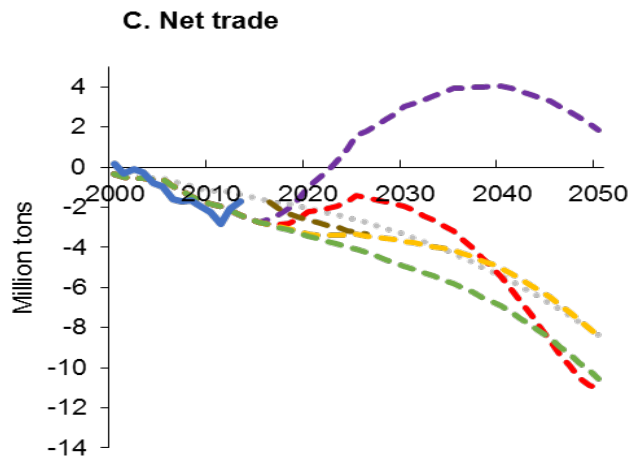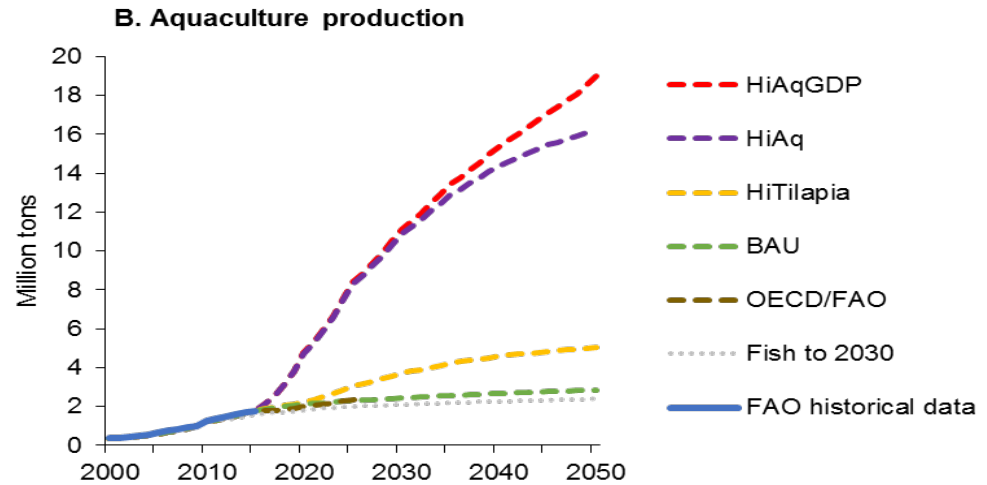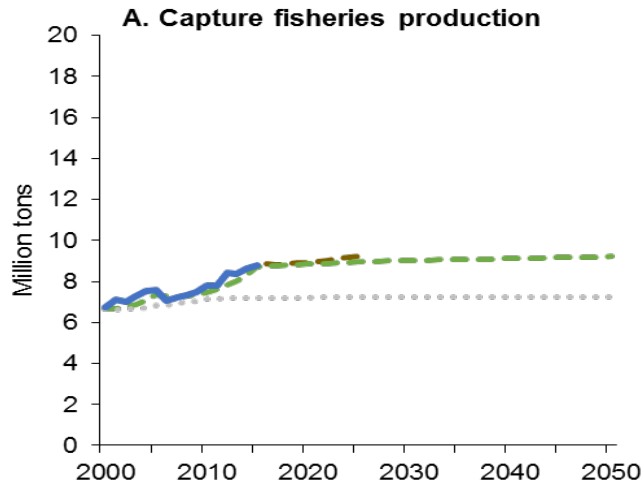
Key Message in Africa fish sector

- Rapid **population** and **income** growth in Africa are fueling rising demand for fish

- Foresight modeling highlights the potential of African **aquaculture** for **food security**

- **Investment** in sustainable African aquaculture can help reduce reliance on imports

- Improved **seafood trade policies** are necessary to meet increasing demand in Africa

- African capacity for **fisheries and aquaculture management** are crucial for the sector

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Fish sector model in Zambia
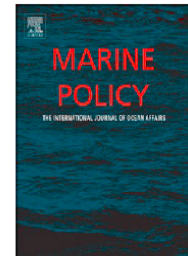
Fish supply and demand for food security in Sub-Saharan Africa: An analysis of the Zambian fish sector

Nhuong Tran[a,*], Long Chu[b], Chin Yee Chan[a], Sven Genschick[c], Michael John Phillips[a], Alexander Shula Kefi[d]

[a] WorldFish, Jalan Batu Maung, Batu Maung, 11960 Penang, Malaysia
[b] Crawford School of Public Policy, The Australian National University, Canberra, ACT 2601, Australia
[c] WorldFish Zambia Office, P.O. Box 51289, Ridgeway, Lusaka 10101, Zambia
[d] Department of Fisheries, P.O. Box 350100, Chilanga 10101, Zambia

Scenarios description in Zambia

1. Business-as-usual
2. Optimistic GDP growth (increase 3% from BAU)
3. Slower GDP growth (decrease 3% from BAU)
4. Stronger fish import tax (increase 50%)
5. Faster commercial aquaculture growth (15% growth)
6. Faster capture fisheries growth (1.5% growth)

Key Message in Zambia fish sector

- Under BAU, fish deficit will increase and **fish imports** will be key contributor for fish consumption by 2030

- Increasing Import tax **unlikely** solves the fish deficit, while it will inflate fish price

- Further **investment** in **aquaculture** could provide solution if input markets for seed and feed are developed
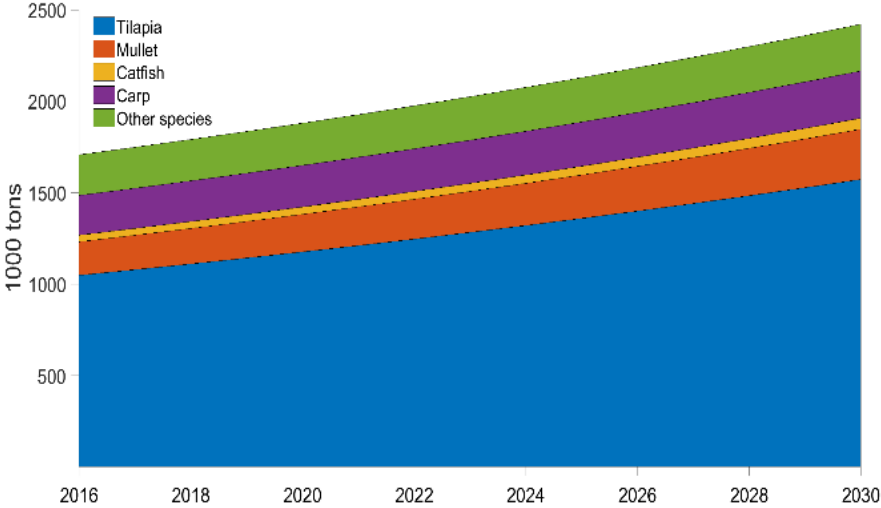

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Fish sector model in Egypt

Key findings in Egypt fish sector

Total production output
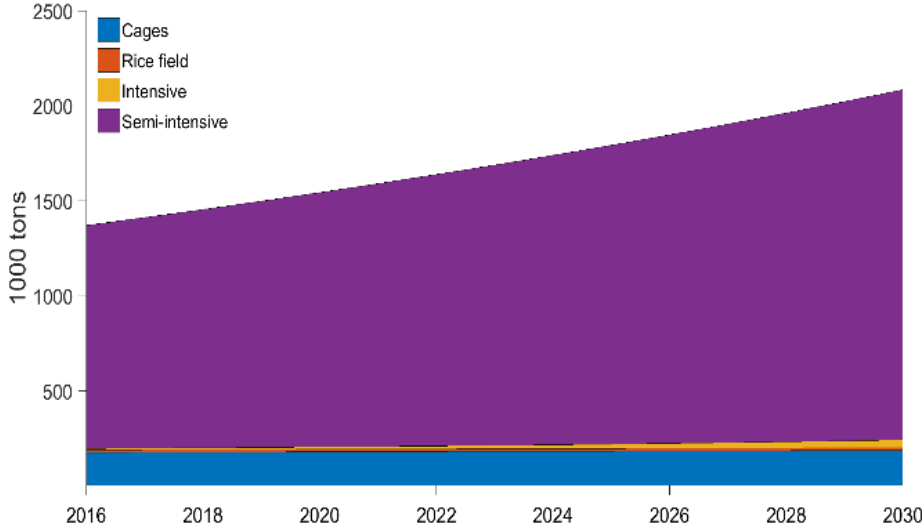
Aquaculture output

Figure 1. Total production and aquaculture output of Egypt in BAU scenario

Scenario description in Egypt

1. Responses to changes in input markets
   - Increase of price of feed and seed by 25% by 2030
   - Technological progress to reduce 1% of feed and seed to produce 1 ton of fish
   - Higher price of water to restrict the usage of freshwater
2. Impact of tax and disease outbreak
   - Higher import tax (10%)
   - Higher export tax (10%)
   - Disease outbreak (5-10% loss rate)

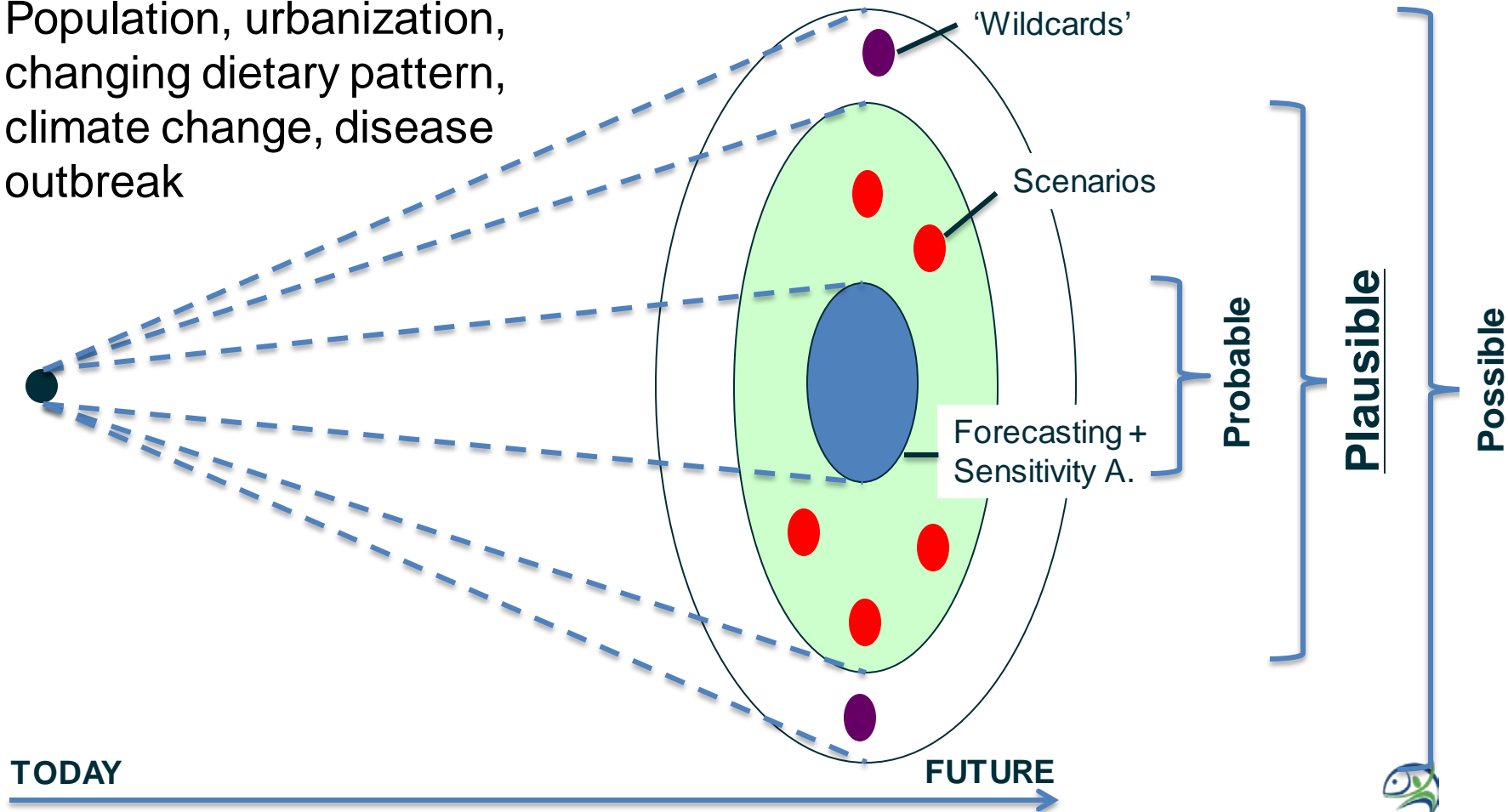**WorldFish**

Key Message in Egypt fish sector

- Egypt's **aquaculture** will play increasingly important roles in meeting the rising demand for fish

- **Less labour-intensive aquaculture** system will grow faster than labour-intensive systems due to rising wage rates

- The increases in demand for **feed, seed, and water** could restrain the growth of Egypt's aquaculture if not effectively managed

- Improvement in **input-use efficiency** is the key in softening the constraints of aquaculture growth

- Infectious disease will affect both producers and consumers, and **disease control** is important in stabilising fish price

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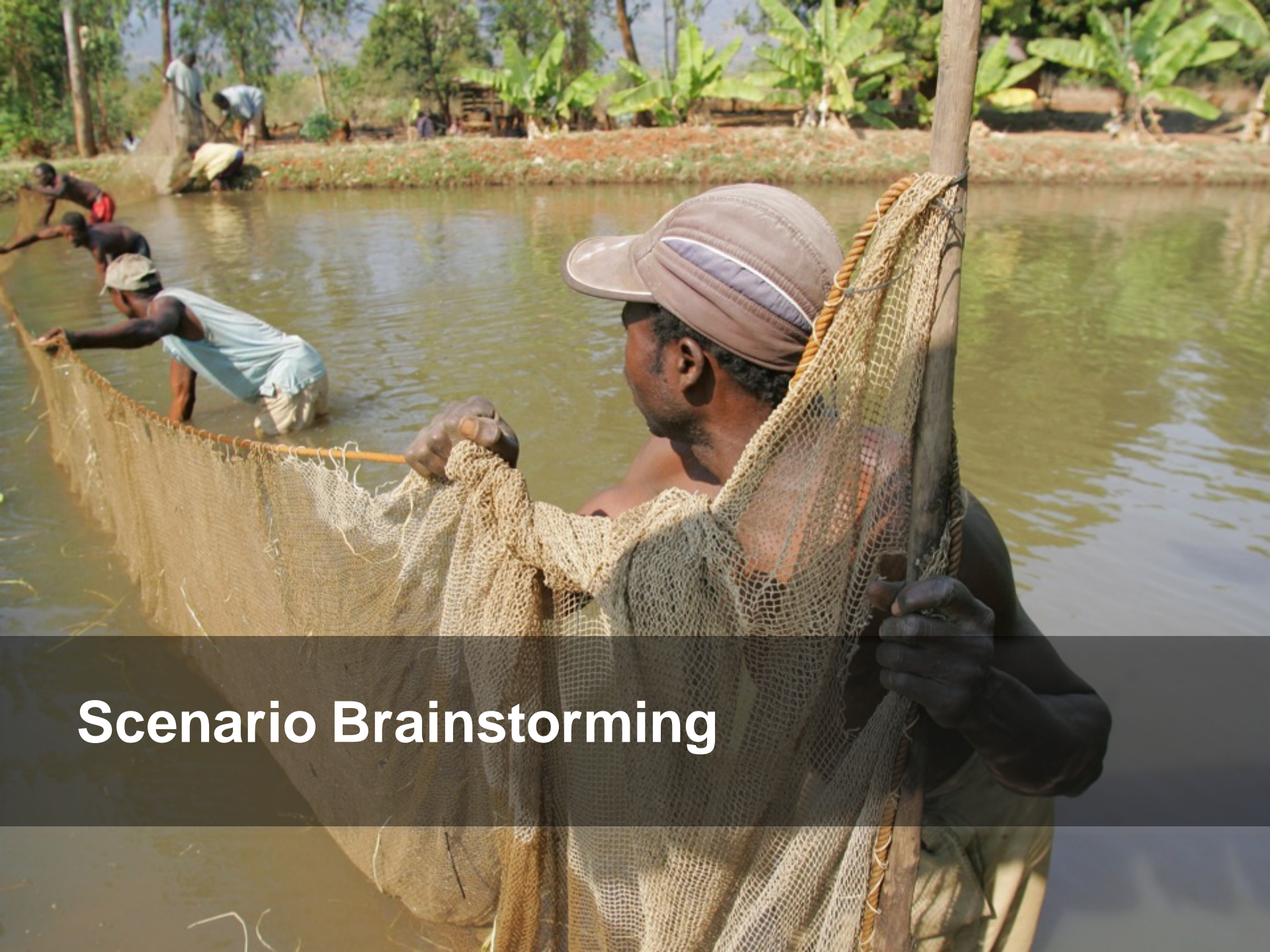
Scenario Brainstorming

Future supply and demand studies?

- How fish sector evolves
- Population, urbanization, changing dietary pattern, climate change, disease outbreak

'Wildcards'

Scenarios

Forecasting + Sensitivity A.

Probable

Plausible

Possible

TODAY

FUTURE

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Scenario Analysis

- A detailed description of **potential** developments from the present to the futures

- Scenarios are **what-if** stories used to explore future uncertainties/decisions

- Scenario analysis's objective is to liberate people's insights and open up the whole spectrum of **future possibilities**

- Help **decision-makers** see some perspectives, causes, and effects related to the decisions to be made

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Scenario exploration exercise
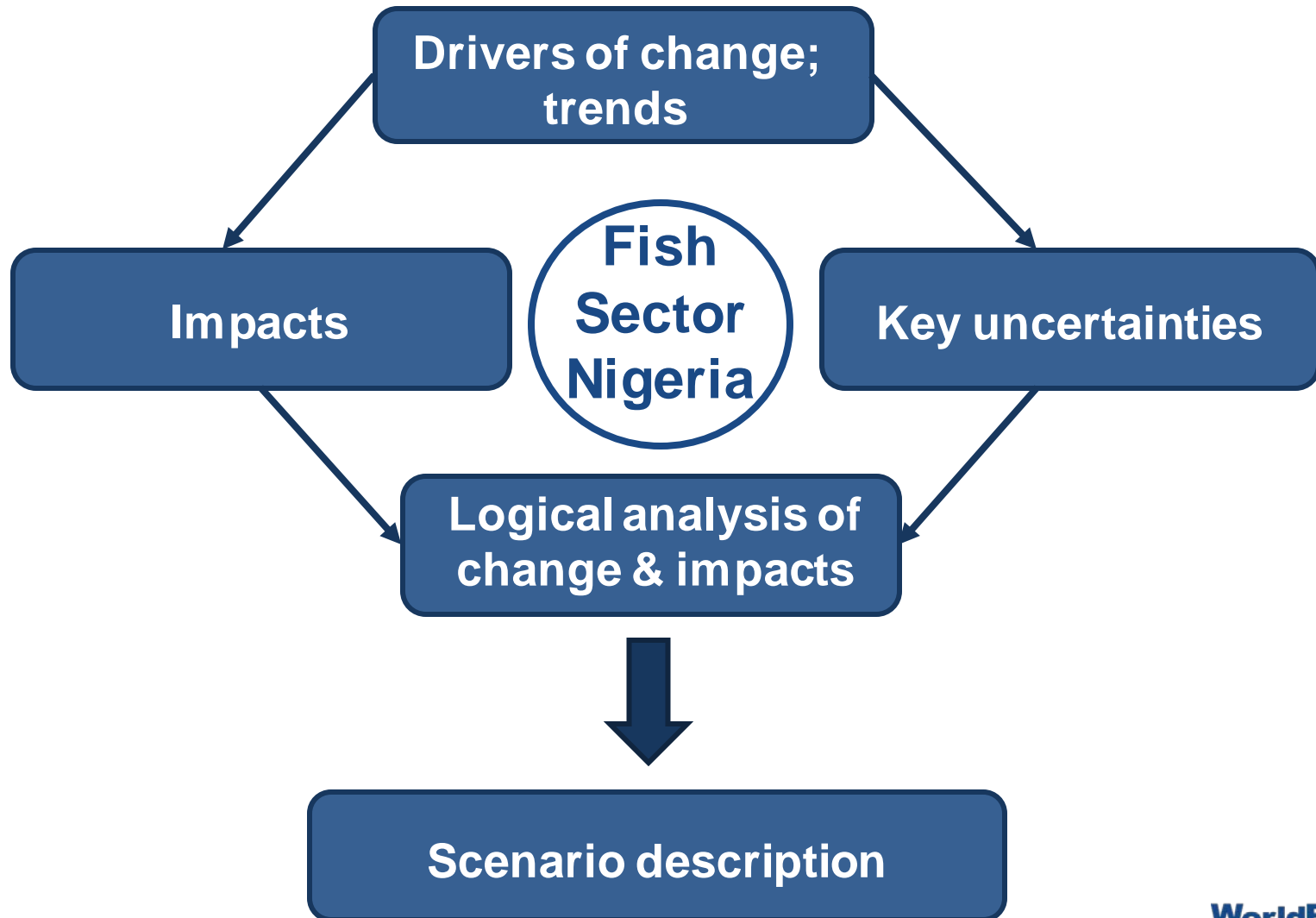
Examples of Drivers of change

- Population growth

- GDP growth

- Technology advancement

- Input prices

- Output prices

- Import and export regulations/policy

Drivers can be combined to create
scenarios to envision plausible futures

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Scenarios Brainstorming

- **Problem identification:** Please think about problems that Nigeria's fish sector is facing: What (seems not right), where (it happens), how it turns out (statistics, interview) and why's it important (e.g., how many people, regions, how popular, policy implication)

- **Trends and channels:** Identify the trends behind the problem (e.g., population growth, climate change, technology progress, diet shift)

- **Controls:** Identify what could be done to control the problem (influencing the driving channels)

- **Consequences:** Identify the consequences of the problem and what may trigger them.

- **Mitigation:** Identify what could be done to mitigate the consequences (should they arise) and any prior experience (if any)

- What **alternative scenarios** would be relevant to Nigeria?

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Plausible Scenarios-1

Reduce aquaculture input cost (5-10%)
- Currently Nigeria imposes high tax on fish feed ingredient imports. This policy is to stimulate domestic/local feed material development. If tax policy change or technological change in fish feed production, feed costs can be reduced. Feed cost is the major cost component in aquaculture production, hence, we can expect fish production costs decrease with more fish feed production efficiency.

Decrease consumer price of fish (?%)
- This trend happens to salmon and shrimp markets. When supply increases due to success in technological progress and mass production of salmon in temperate countries (Norway, Scotland and Chile), and shrimp in tropical countries, consumer prices decline.

Successful stock enhancement in capture fisheries (?% increase of capture fisheries output)
- Capture fisheries contribution to fish output increases. What is the impact on other outcome domains of the fish sector model?

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Plausible Scenarios-2

Weak/strong currency of Naira (?%)

- Variation of exchange rate/currency; what is the impact on fish trade?

Reduce tax of imported feed (?%)

- Current government policy is to strongly regulate/restrict fish feed ingredients to encourage domestic production. What happen if government reduce tax of importing feed ingredients? It is likely that large scale sector will invest in feed industry to boost feed production and reduce feed costs.

Increase small scale aquaculture share of output (?%)

- Commercial/large scale farmers play more important role in the current markets. What are the roles and opportunities for small producers? What solutions needed to support small producers?

Consumption of cultured species diversification

There is a dynamic relation among population growth among different tribes and states. What is preference of different fish species/type consumption in different regions (north/south; urban/rural)?

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Plausible Scenarios-3

Cultural preference and taboos on fish consumption
- The northern region people dislike catfish but prefer small fish. Promotion of tilapia may be a good choice in the northern region of the country.

Climate change impact on aquaculture and capture fisheries (?%)
- Under climate change scenario, wild-catch output fluctuates (little in some years while abundant in others). When wild-catch fish is a substitute for farmed fish, this creates uncertainty in the demand for aquaculture products. When the wild-catch output is low, the demand for farmed fish is high, so farmers have incentives to invest in aquaculture infrastructure (usually long-term investment). However, when the wild-catch output is abundant, the demand for aquaculture product is low.

Market segmentation (urban/rural)
- Fish demand is also govern by the market segmentation. Aspect of market segmentation could act as economies for fish demand behavior. One example is influence of rate of urbanization on fish demand.

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Thank You