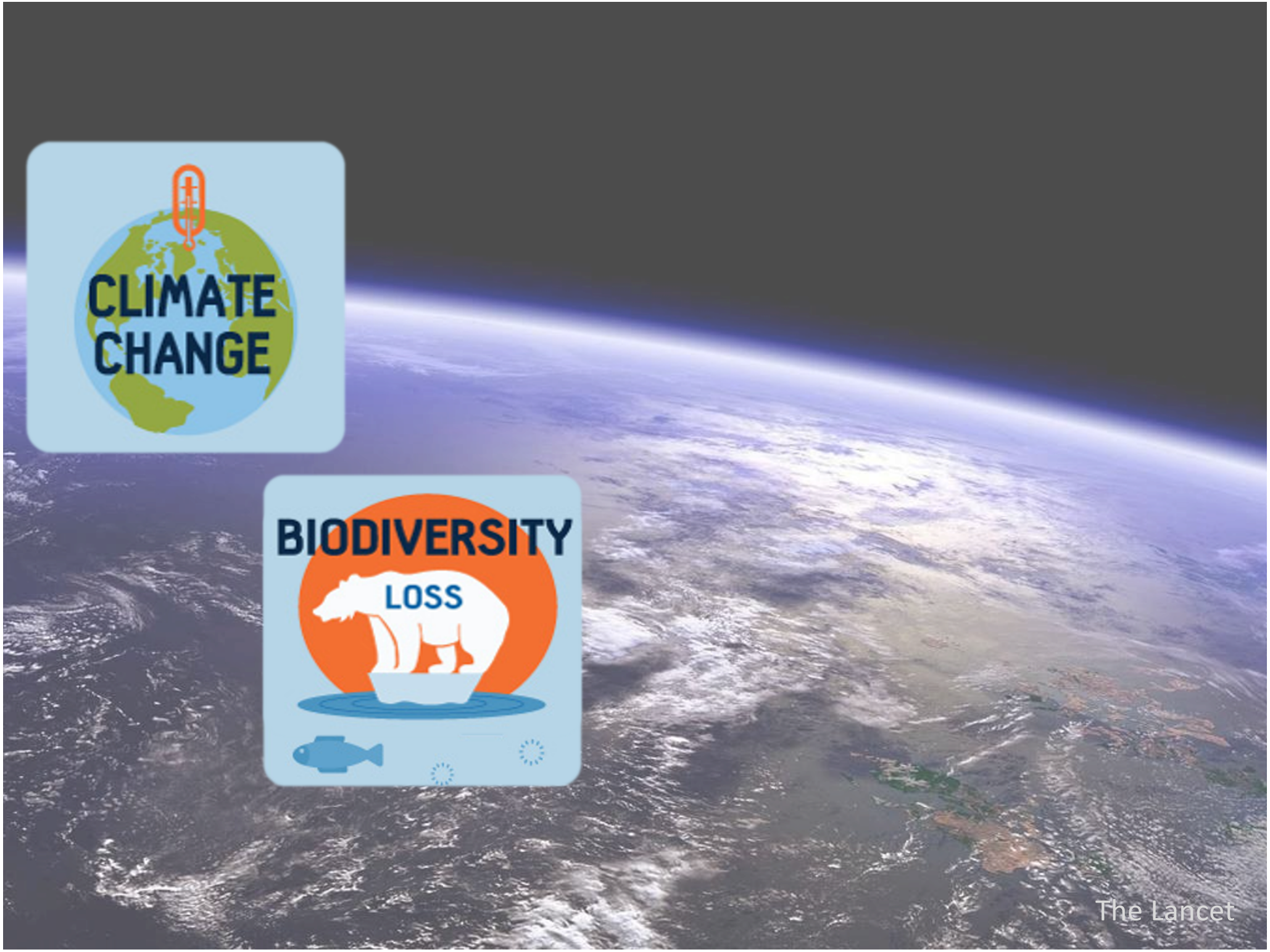
Environmental Change, Fish, and Food Security: A social-ecological approach to health

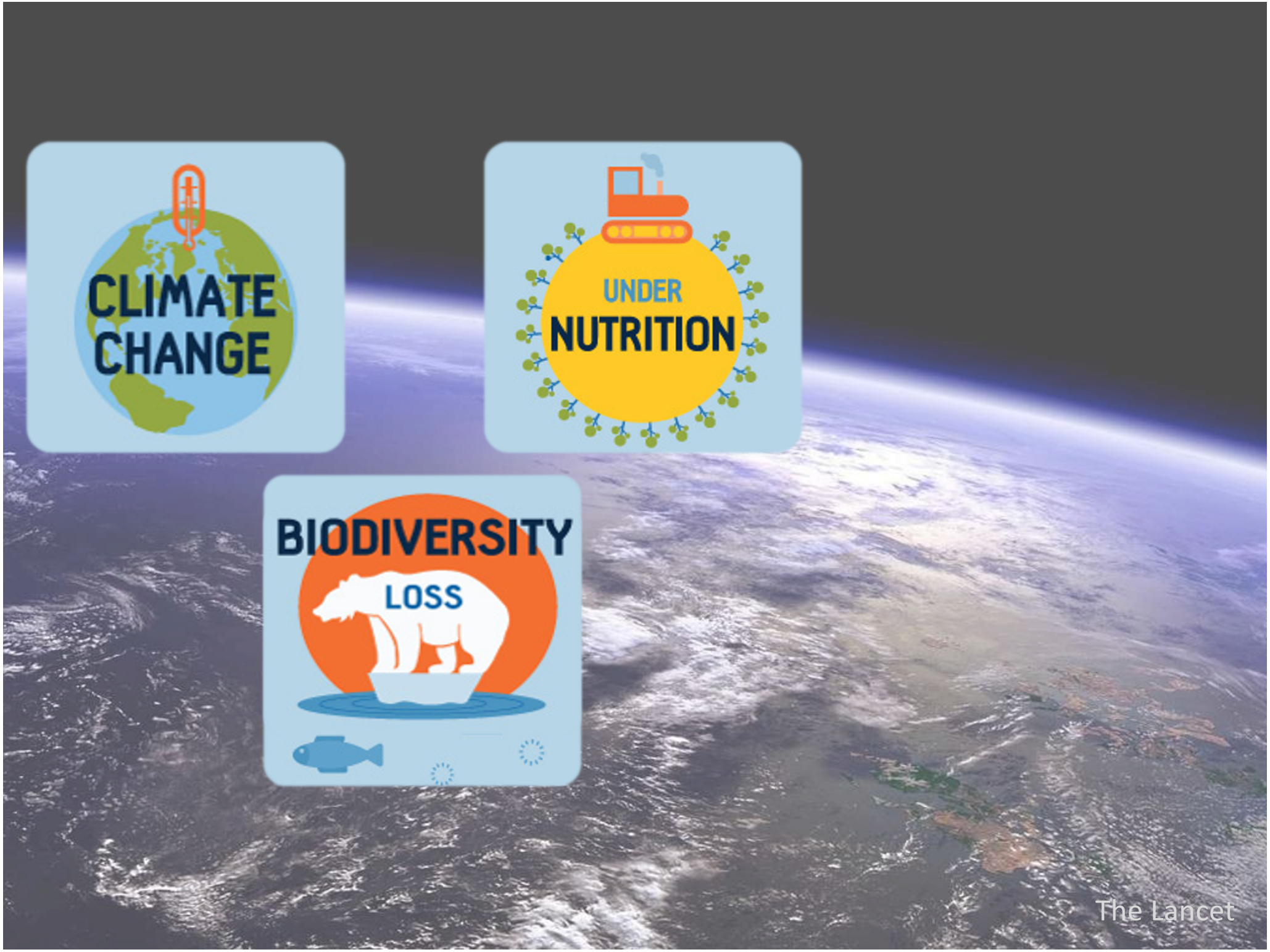
Katie Fiorella

Asst Professor
Cornell University


Elektro-L


CLIMATE
CHANGE
The Lancet


CLIMATE CHANGE
BIODIVERSITY LOSS
The Lancet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UNDER NUTRITION
BIODIVERSITY LOSS
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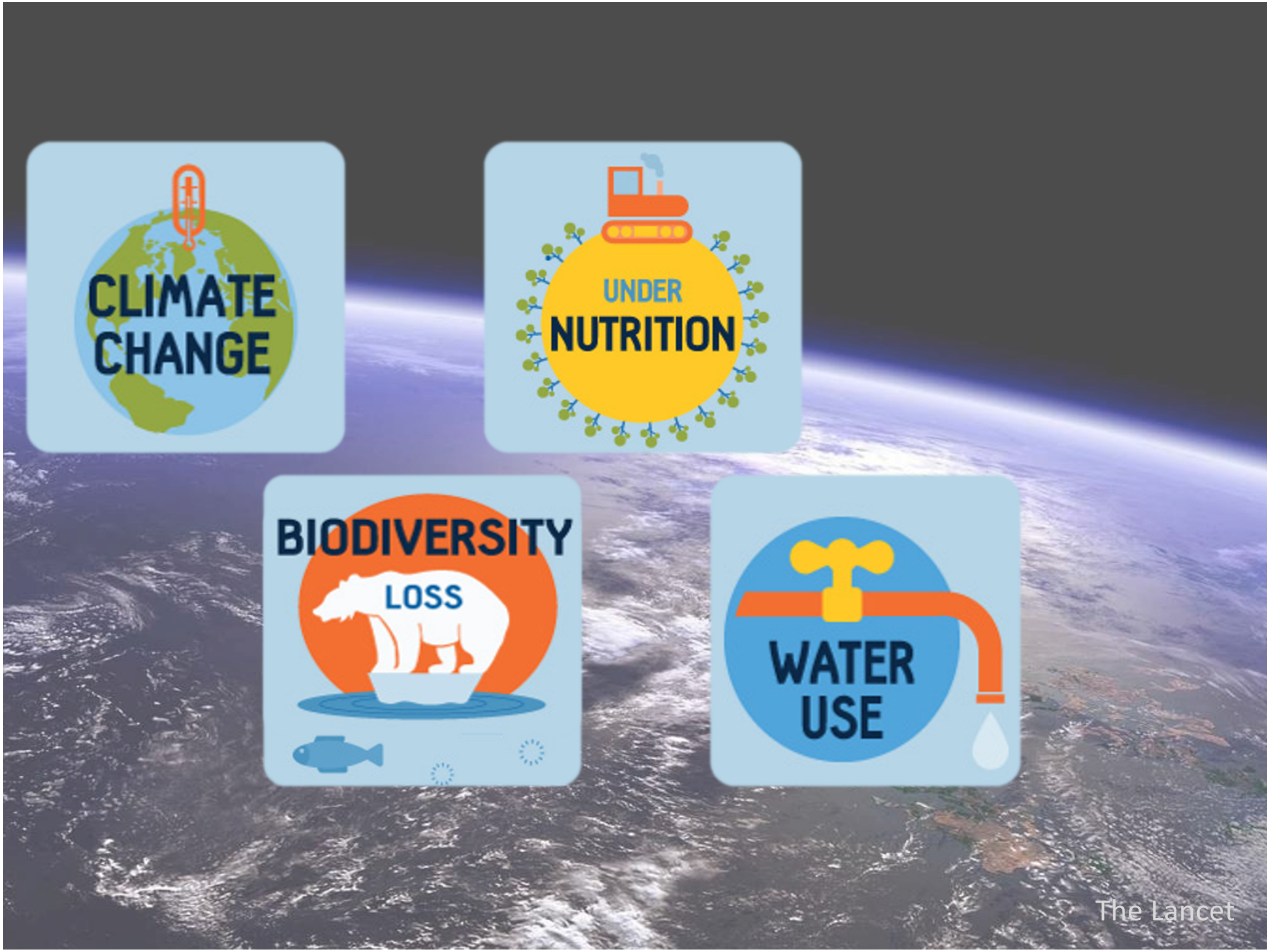
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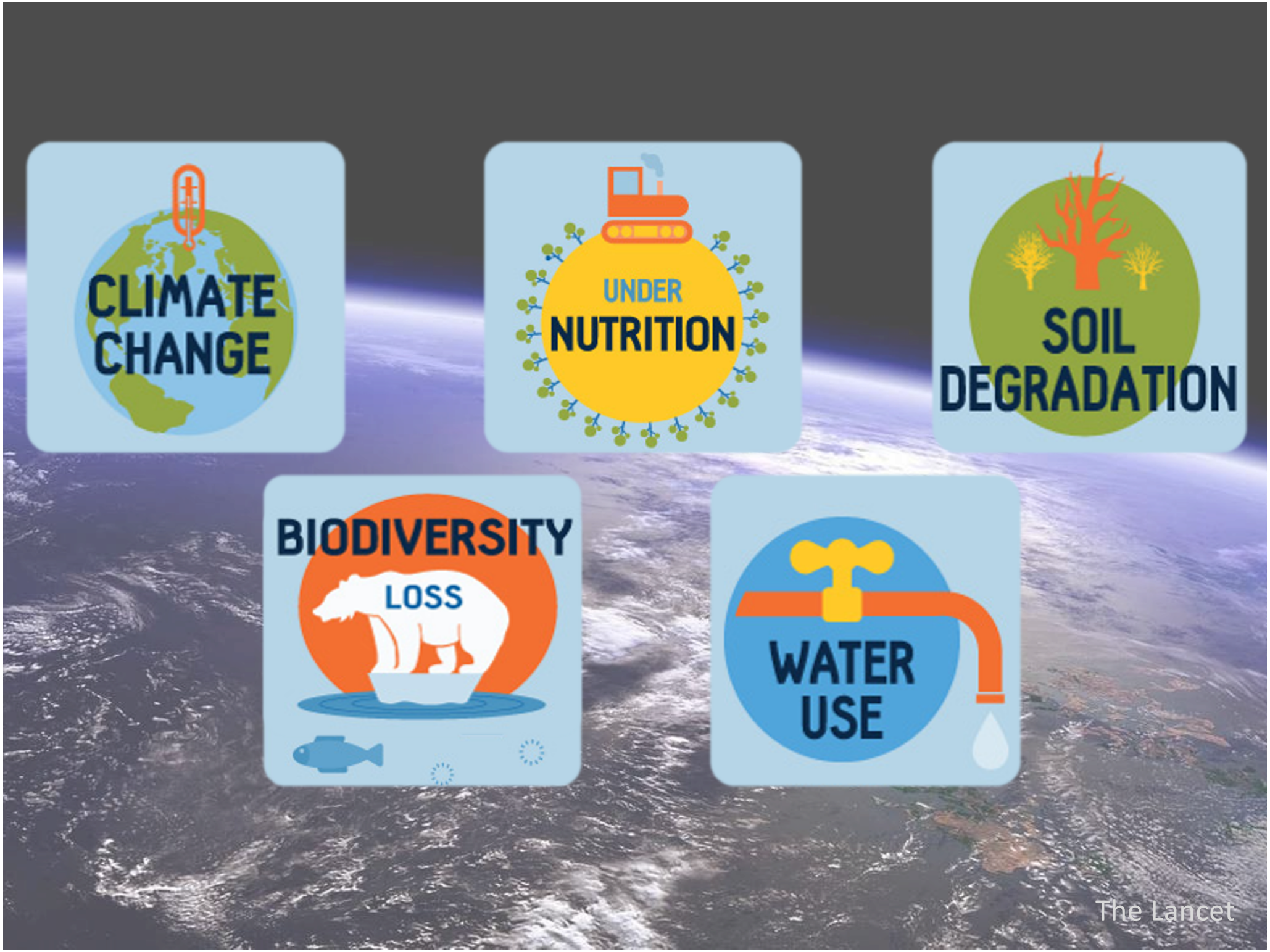
WATER USE
The Lancet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UNDER NUTRITION
SOIL DEGRADATION
BIODIVERSITY LOSS
WATER USE
The Lancet


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
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5 GENDER EQUALITY
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SUSTAINABLE DEVELOPMENT GOALS

(more) Environmental Goals:

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Global Fisheries

Global Fisheries

Global Fisheries

Global Fisheries

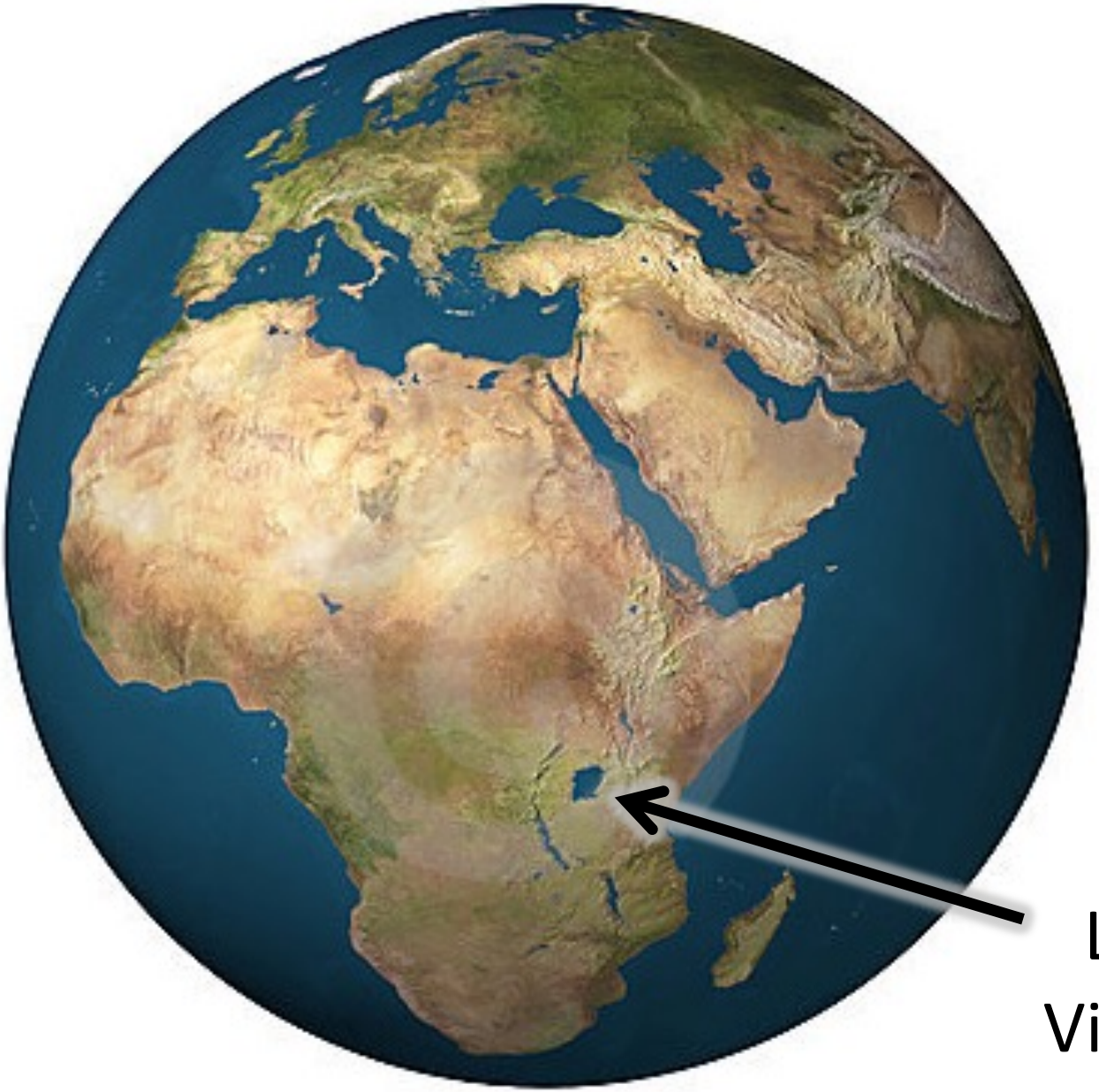
10% of people are in the fisheries sector

Rabobank, 2015

Global Fish Trade

Rabobank, 2015

Lake Victoria Fishery



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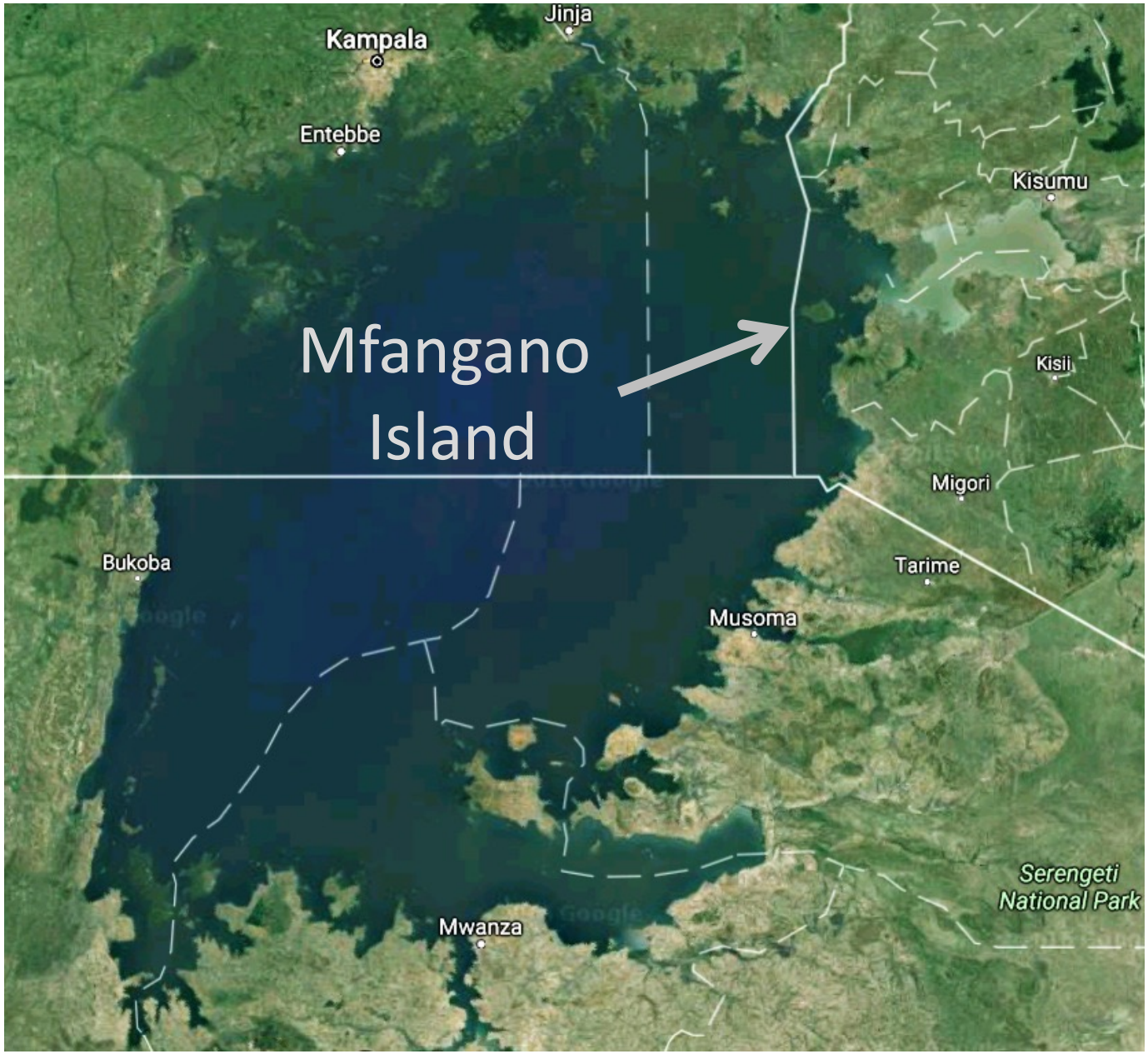

Environment

Livelihoods

Environment

Livelihoods

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Food Access

Livelihoods

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Nutrition

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Disease

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Lake Victoria: The Rise of Nile Perch

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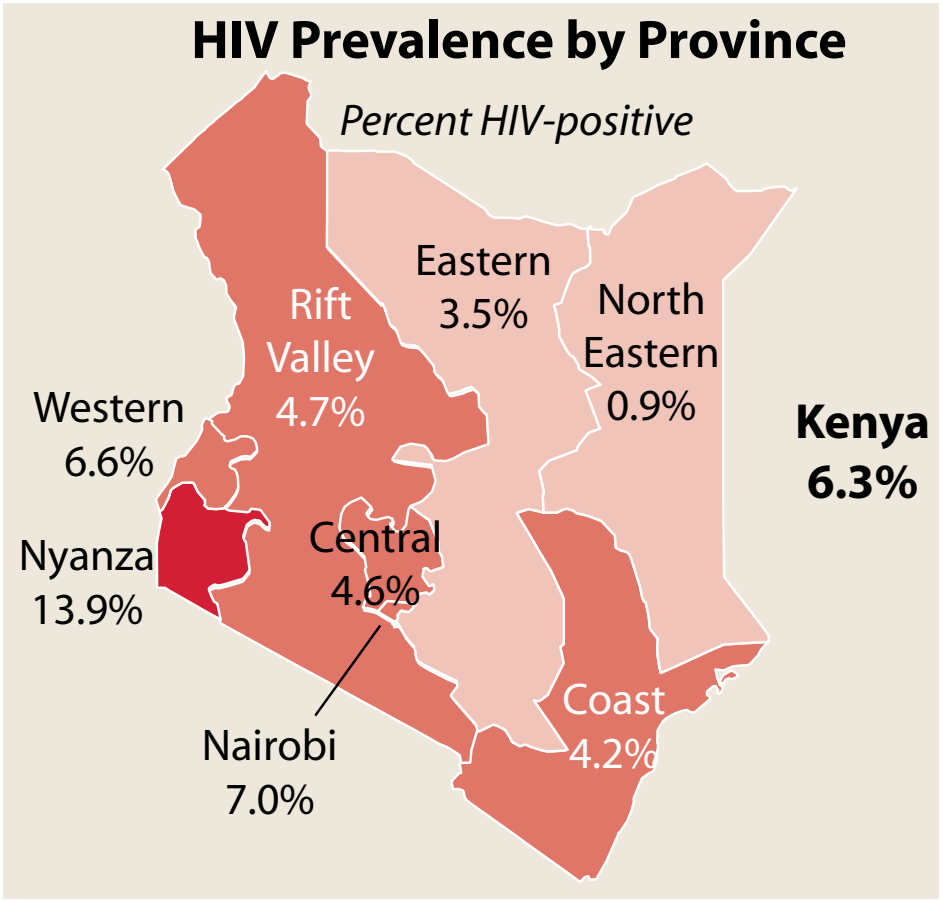
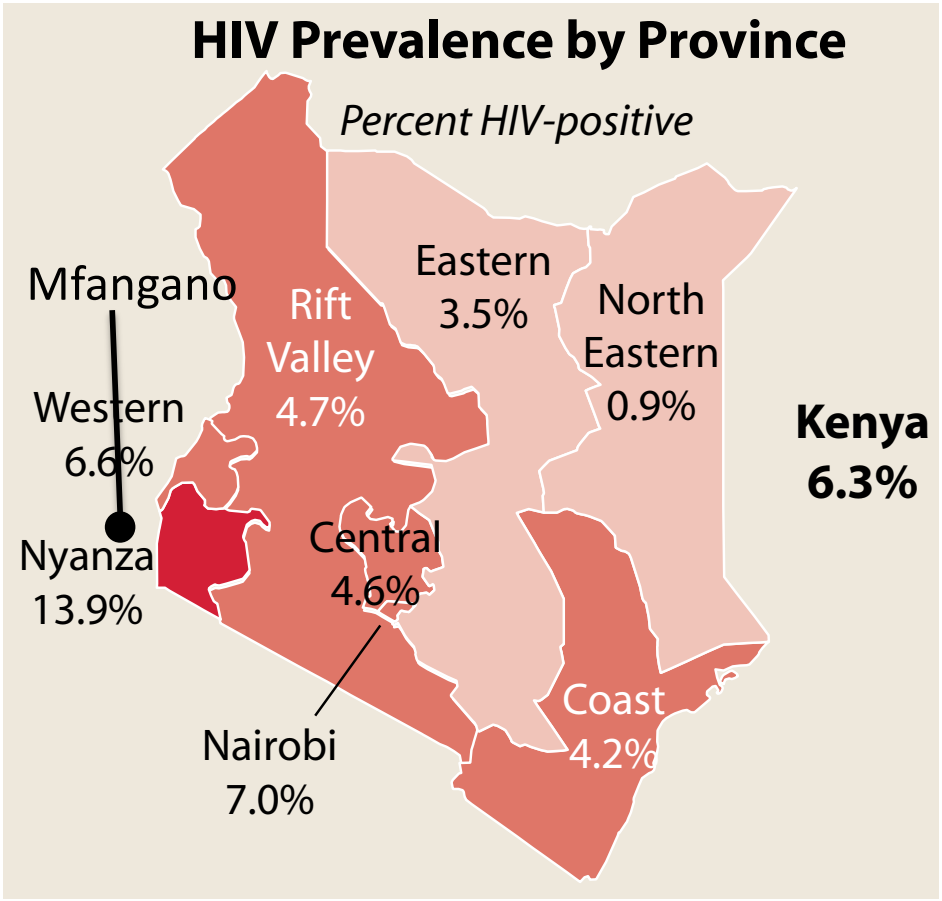


2010 Kenya Demographic Health Survey

Lake Victoria: The Rise of Nile Perch



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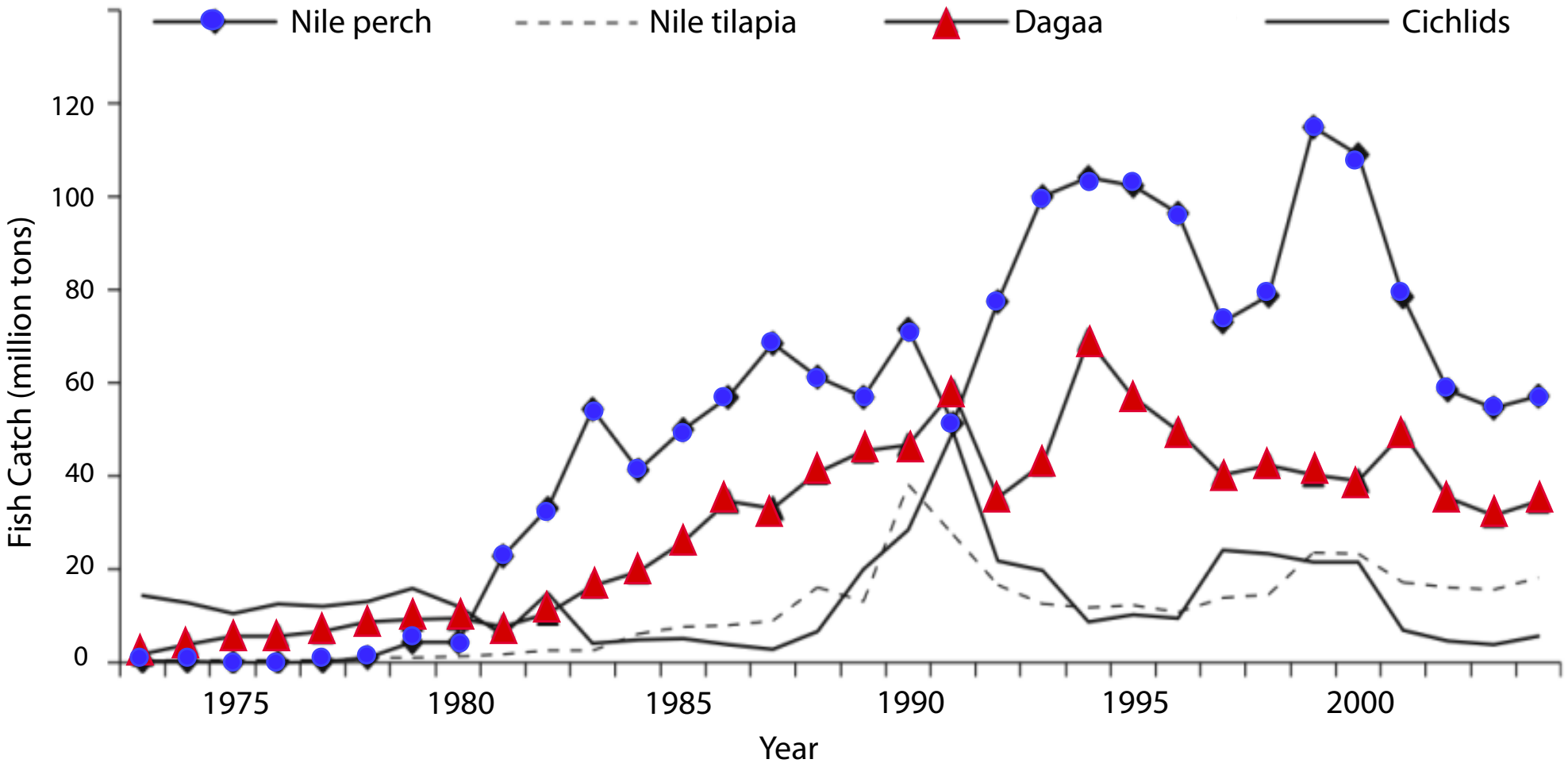
Declining Lake Victoria Fish Catch



Njiru, et al. 2007

Lake Victoria Fisheries

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	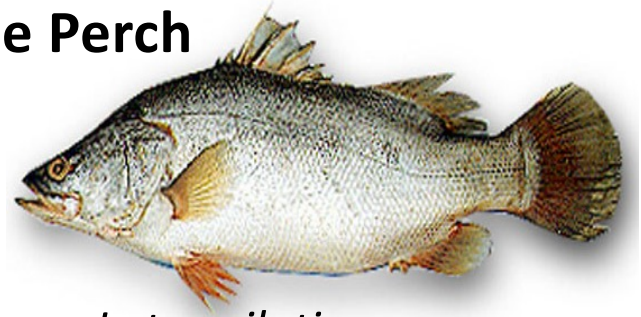
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Lake Victoria Fisheries

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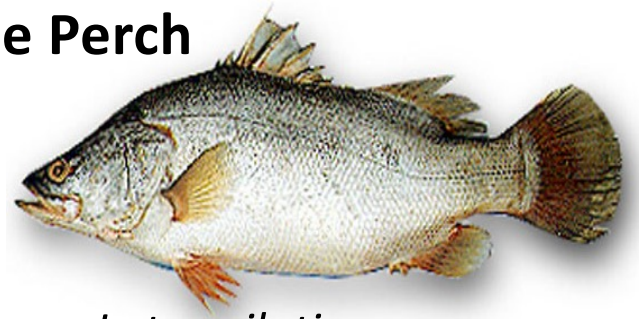

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	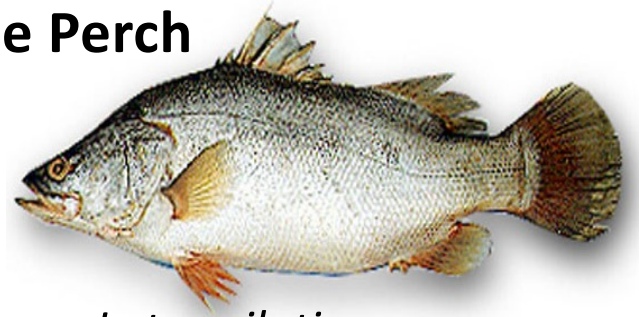
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Fish Size, Fish Access

Lake Victoria Fisheries

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	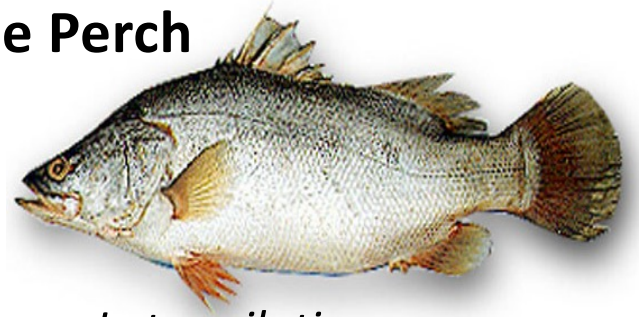 *Lates niloticus*	 *Rastrineobola argentea*
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	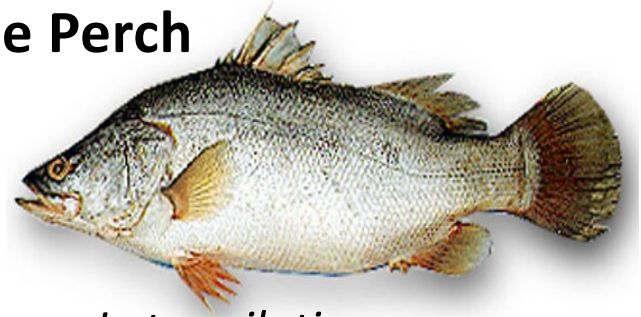 *Lates niloticus*	 *Rastrineobola argentea*
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	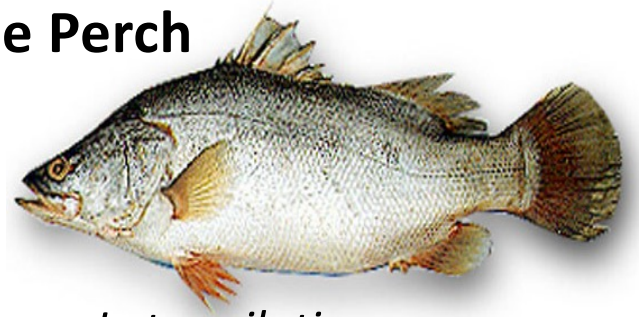 *Lates niloticus*	 *Rastrineobola argentea*
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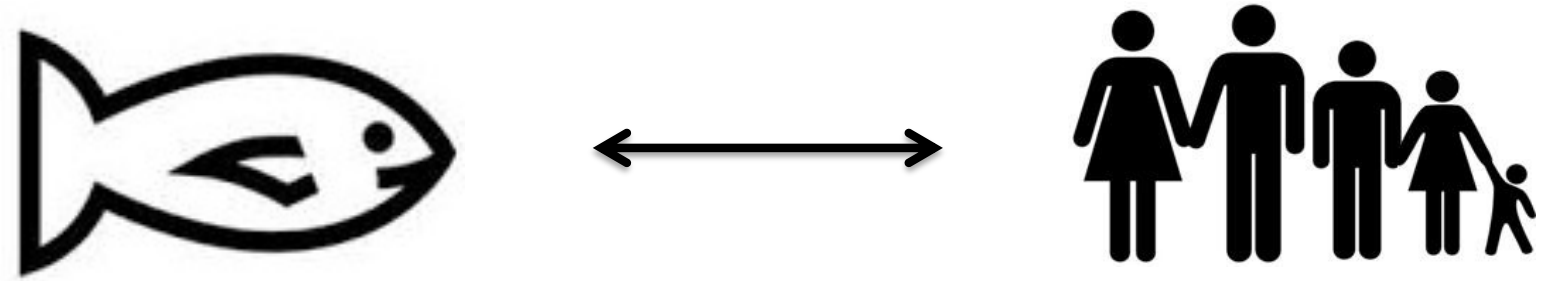

Data and Methods

Ecological Monitoring

19 Beach Management Units (fishery co-managers)

- Catch
- Price
- Effort

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Mfangano Cohort

303 households with a child <2 years, randomly sampled

2-year cohort survey

- Illness
- Fish consumption
- Child growth, cognitive dev.

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Fishing activities, perceived fish access, Income

Qualitative: In-depth interviews, Focus groups

Research Partners


Research Team


Kitawi Beach Management Unit


Community Advisory Group

Livelihoods

Environment

Food Access

What factors shape fish consumption?

Disease

Nutrition

Do fishing households eat more fish?

Fiorella et al, 2014, *Food Security*

Fishing households do not eat more fish

Fish consumption
(Odds ratio; 1=high fish consumption, 0=low fish consumption)

	Bivariate	Full Model
Asset Index	1.47**	--
Monthly Income (Log)	2.58***	2.40***
Num. in household	1.15	--
Education	1.33	--
Fishing Household	1.18	--
Food Security	1.22**	1.18*
Adult Morbidity	0.47*	0.48

*p<0.05, **p<0.01, ***p<0.001

Household Food Security
(Odds ratio; 1=food secure/mildly insecure, 0=moderately/severely insecure)

	Bivariate	Full Model
Asset Index	1.52***	1.37*
Monthly Income (Log)	2.08**	1.67*
Num. in household	0.97	--
Education	1.18	--
Fishing Household	1.46	--
Fish Consumption	2.60**	--
Adult Morbidity	0.63	--

Multivariate Logistic Regression

Fiorella et al, 2014, *Food Security*

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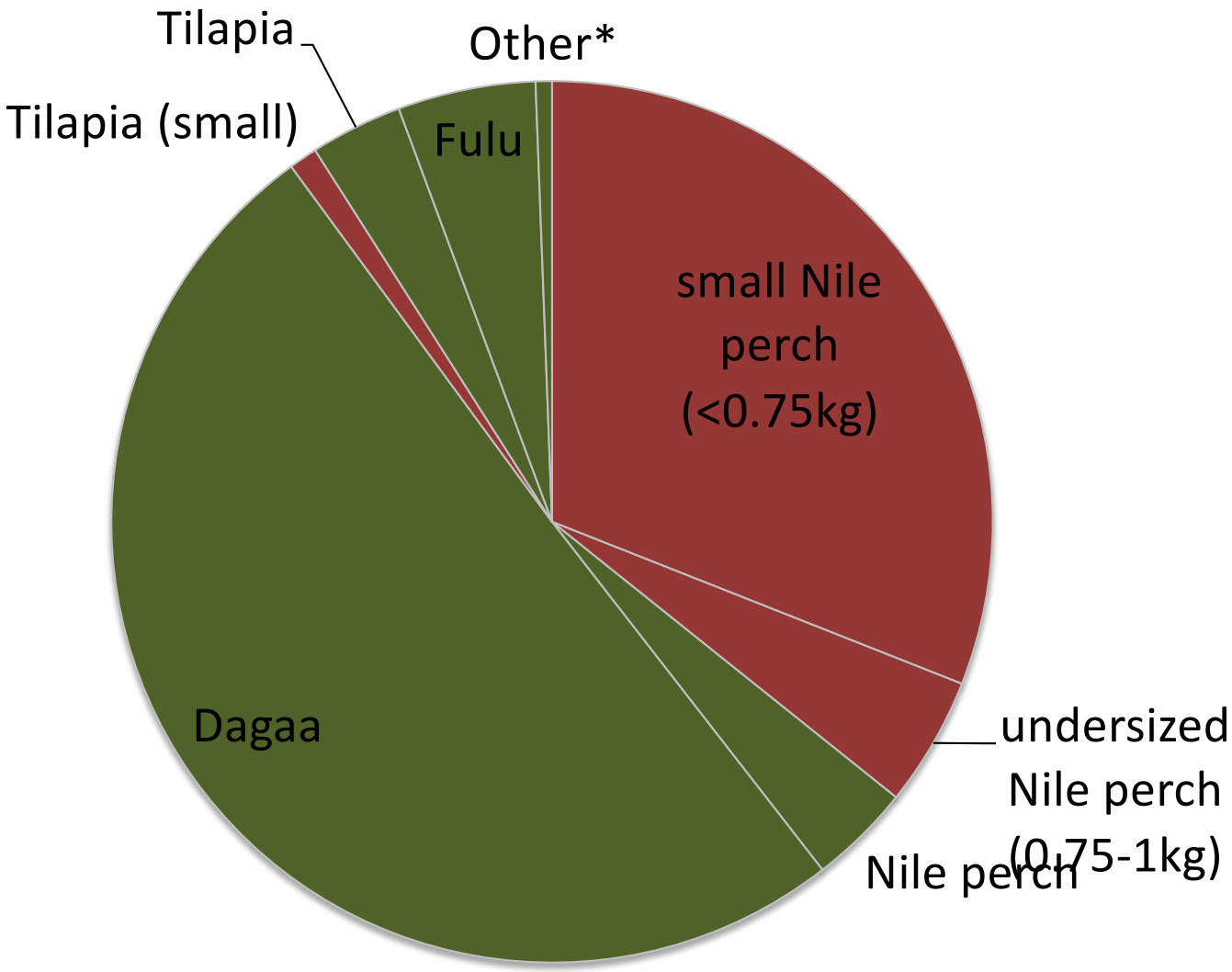
Types of Fish Consumed

303 households across 5 time points

37% of all fish and 90% of Nile perch consumed are below legal catch size



Fishery ecology, economy, and governance mediate fish access

- Fishing households do not eat more fish
- Fishery economy has a two-tiered pricing and access system

Livelihoods

Environment

How does fisher illness affect fishing practices?

Food Access

Disease

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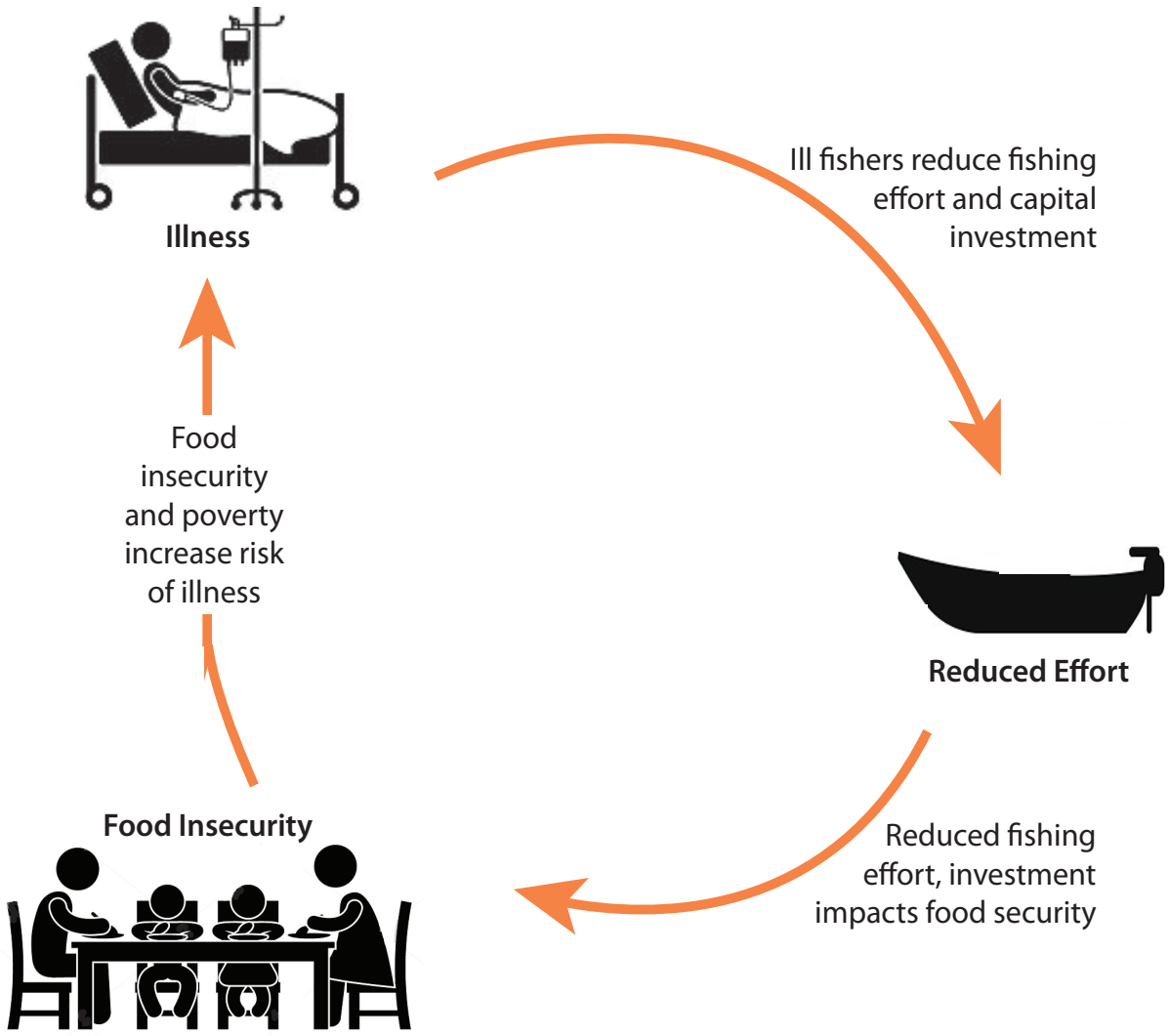
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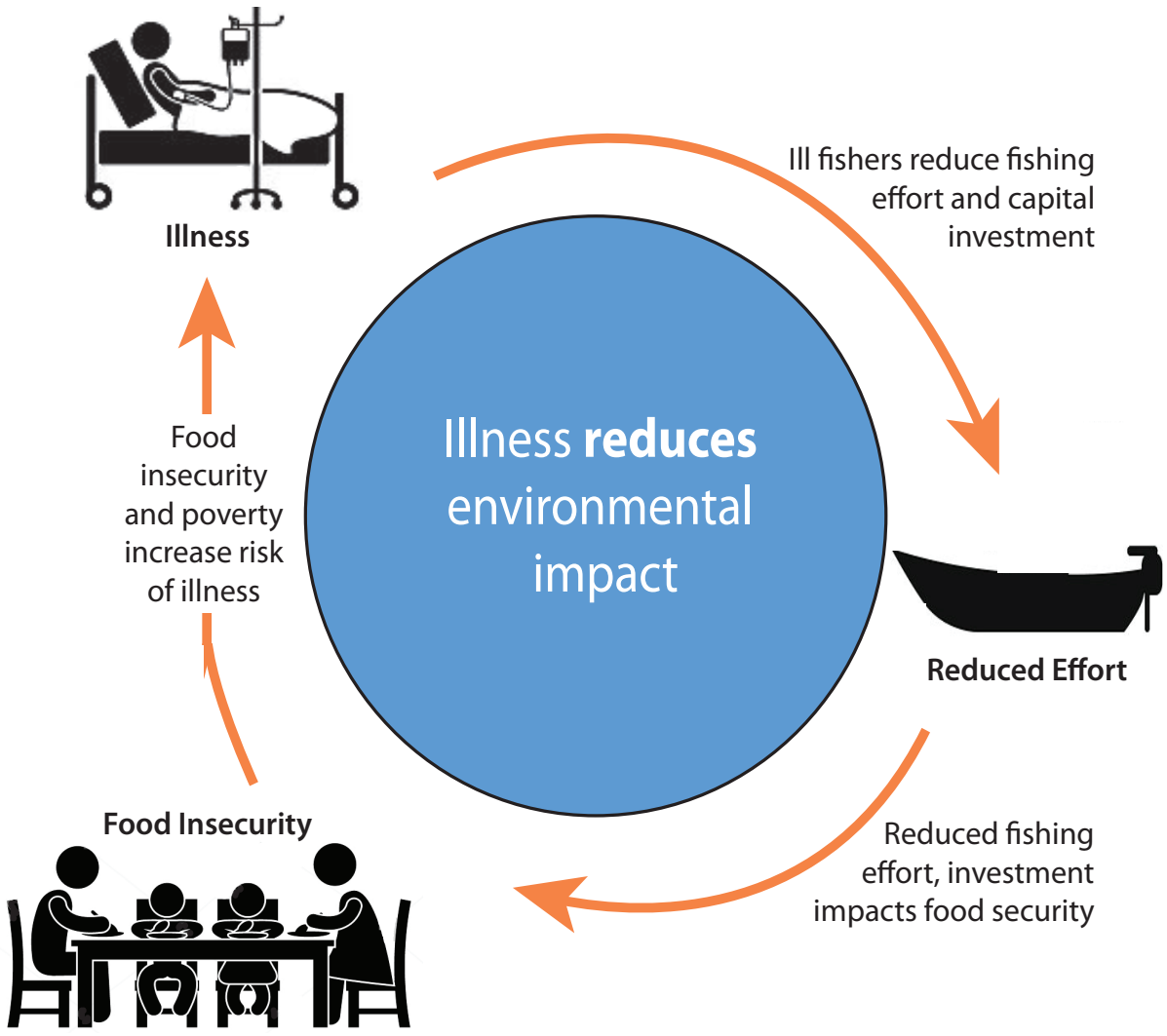
Ill fishers reduce fishing effort and capital investment
Reduced Effort
Reduced fishing effort, investment impacts food security
Food Insecurity
Food insecurity and poverty increase risk of illness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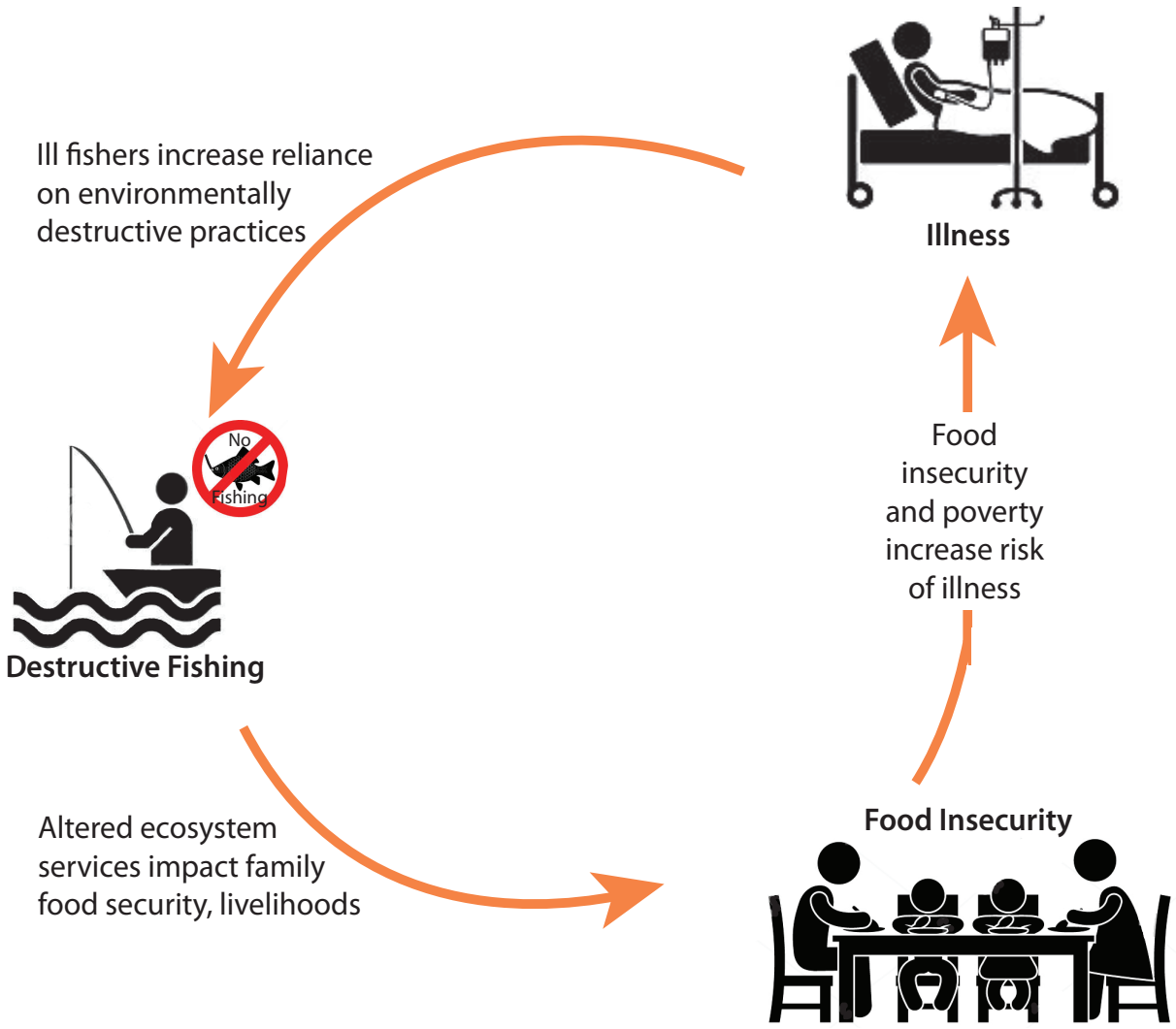
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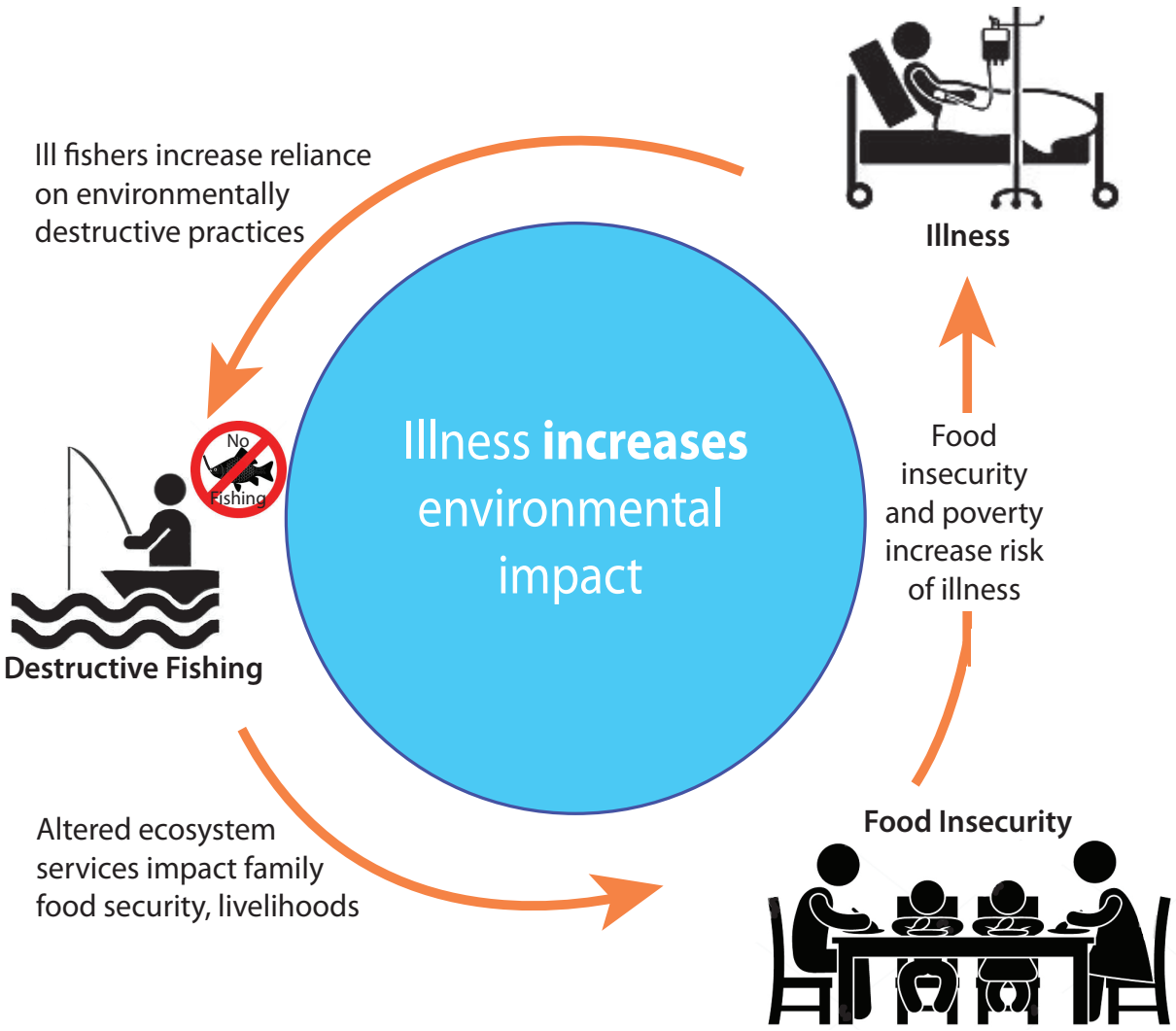
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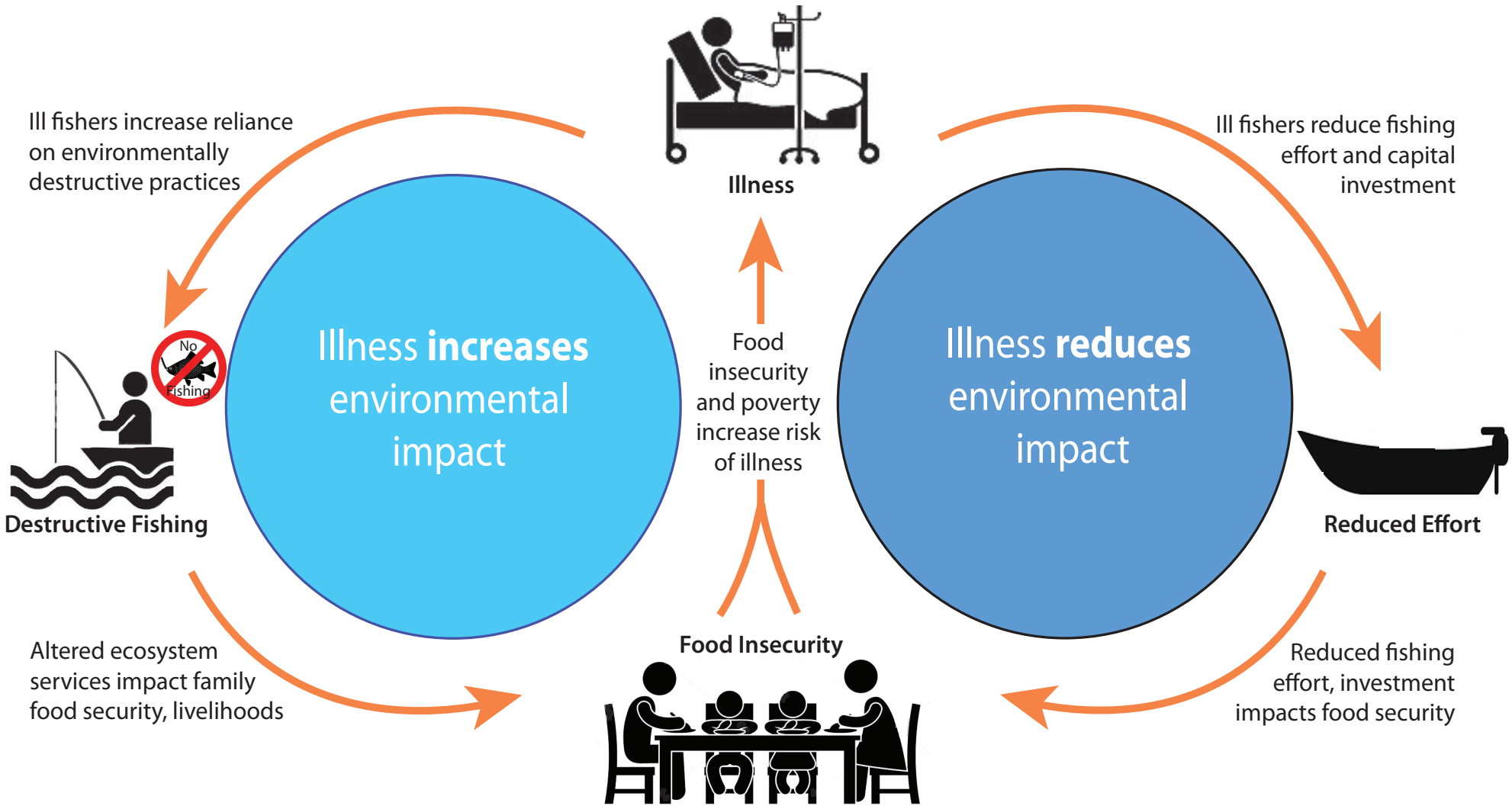
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How does fisher illness impact fishing practices?

Mfangano Cohort:

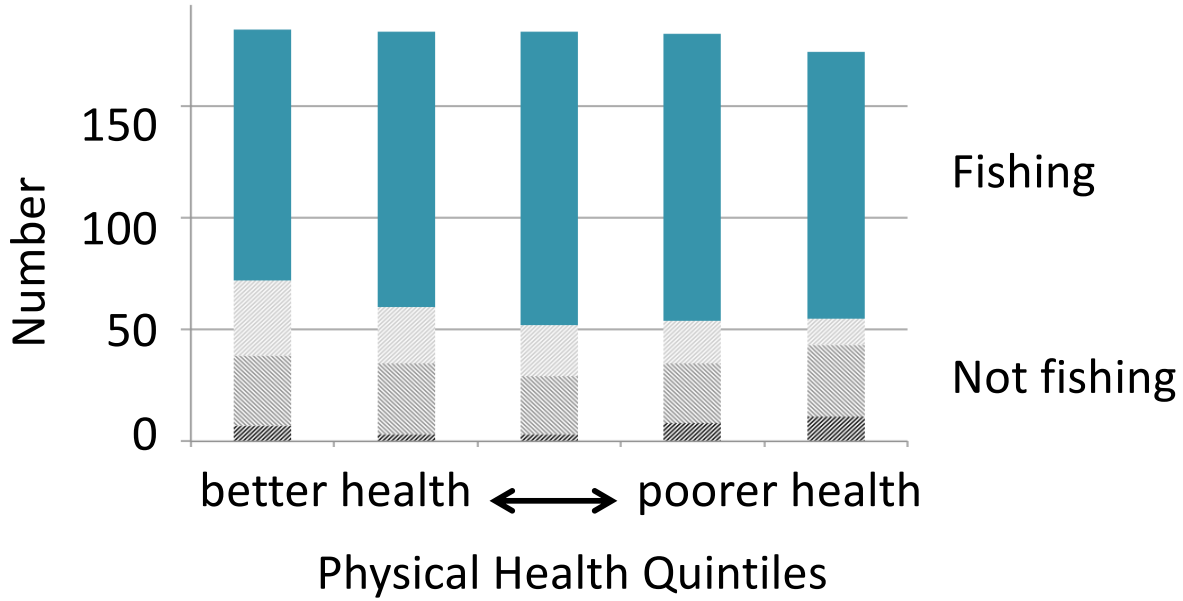
- 248 fishers
- Repeat measures- 0, 3, 6, 12 months

Measures:

- Measured Outcomes Survey-HIV, mental/physical health score
- Fishing activities profile

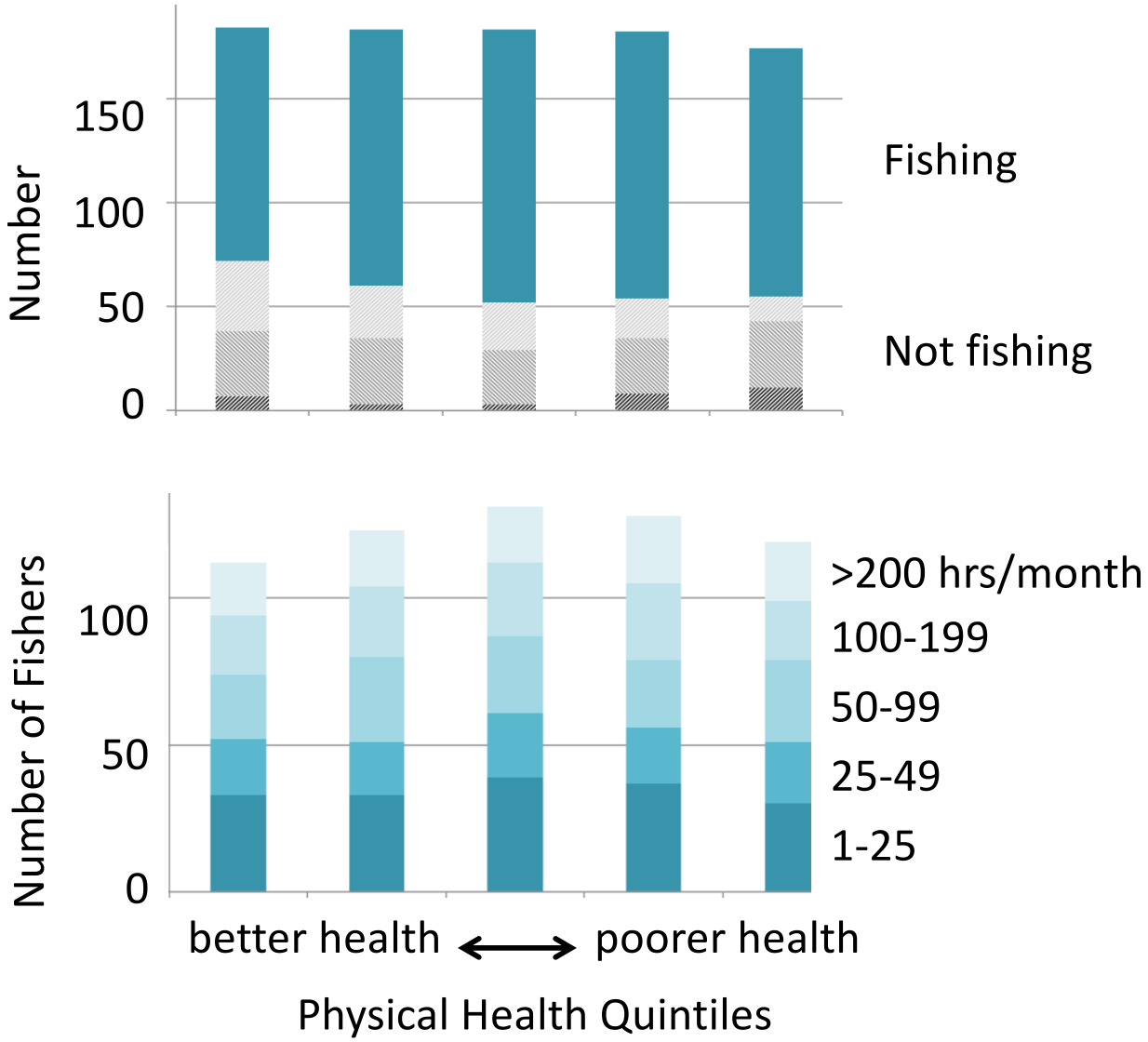
Fiorella, 2013, *American Journal of Public Health;* Fiorella et al, *PNAS.*

Effects of Illness on Fishing Participation



Fixed-effect conditional logit models; controlled for season, income, and fishery role

Effects of Illness on Fishing Effort



Panel regression models; controlled for season, income, and fishery role

Beach Seine

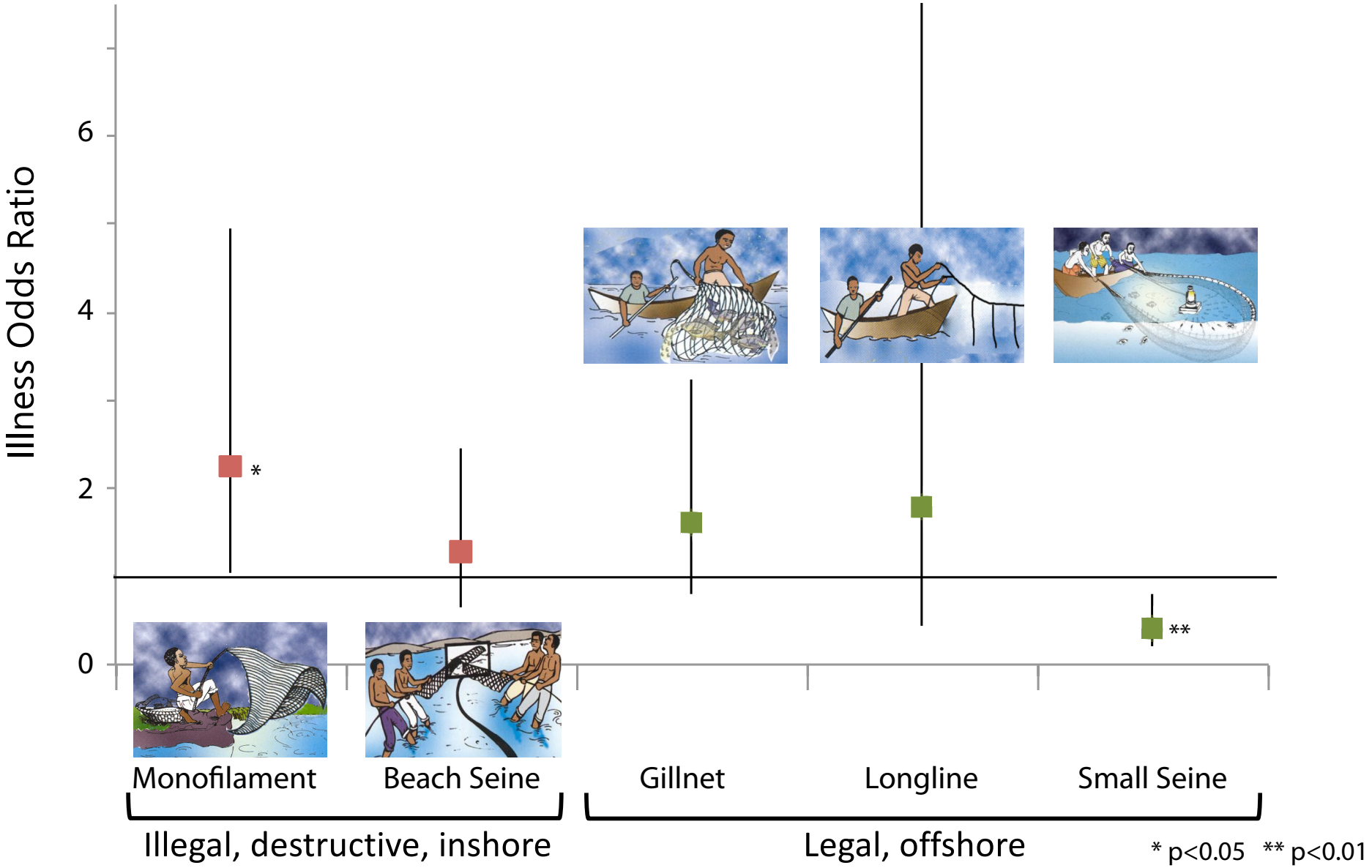
(illegal, destructive; Nile perch)

Video: K. Gaynor

Light Fishing
(legal, dagaa)

Video: CCTV 2012

Odds of fishing method with poorer health



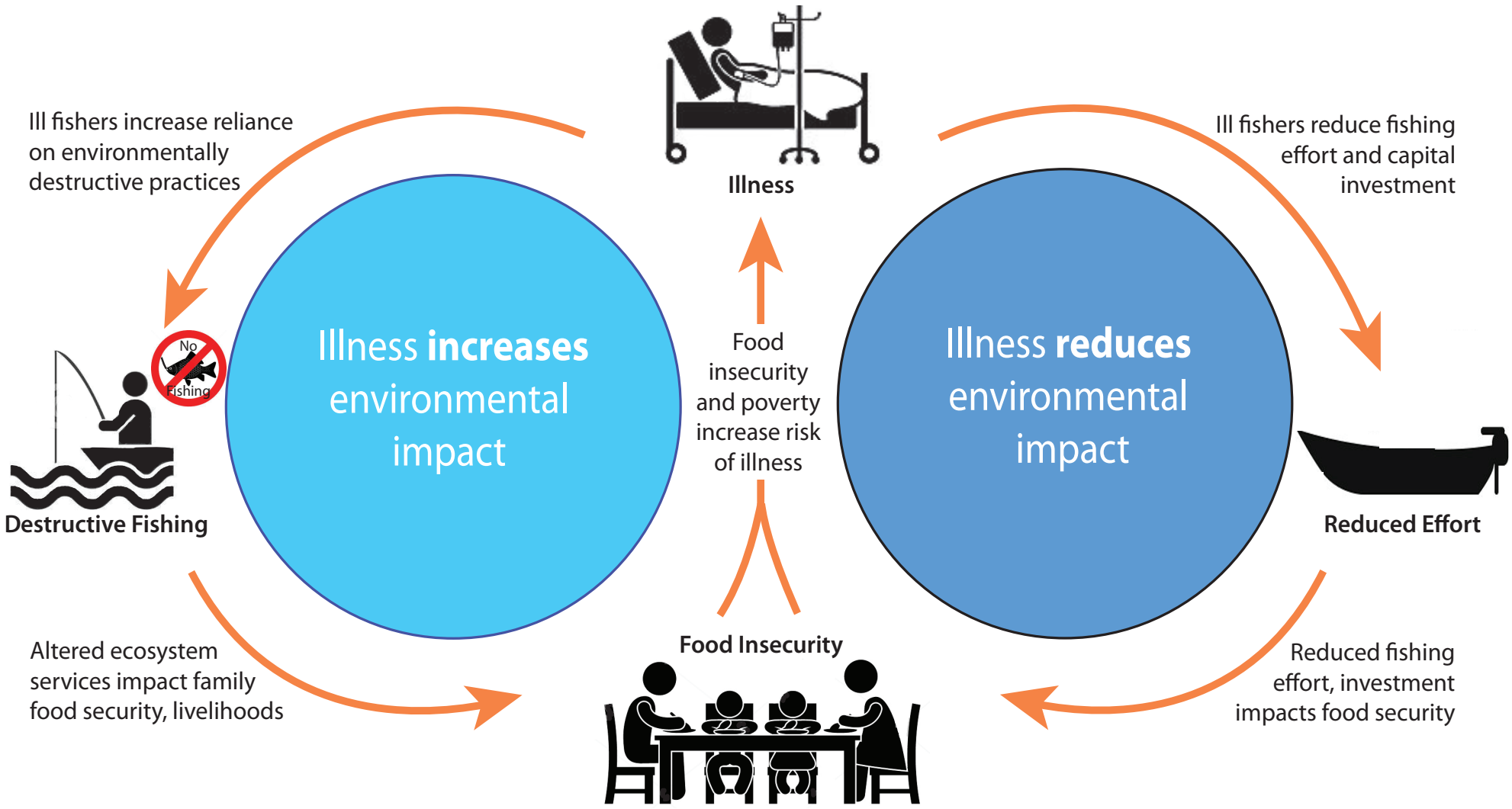
Fixed-effect conditional logit models; controlled for season, income, and fishery role

Human illness may impact environmental sustainability

- Illness moderated by selection of methods, not effort

Human illness may impact environmental sustainability

- Illness moderated by selection of methods, not effort
- Analog to other ecosystems, illnesses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Livelihoods

Environment

How does fish decline affect fish-for-sex exchanges?

Food Access

Disease

Nutrition

How does fish decline affect fish-for-sex exchanges?

Mfangano Cohort:

- Cross sectional
- 303 women and 248 men

Qualitative In-Depth Interviews:

- 30 participants in fish-for-sex exchanges
- 16 women, 14 men
- Range of fishery roles – fish species, laborer / owners, etc

Fiorella et al, 2015, *World Development*

Fish for sex exchanges are common

Prevalence of exchanges: **Women 31 (10%)**
Men 84 (34%)

Household Survey (303 women, 248 men)


KESIA DANI

Fish declines

Long-term Fish Declines (months, years):

- Weaken fish-for-sex relationships
- Push people out of the fishery

Fish declines

Long-term Fish Declines (months, years):

- Weaken fish-for-sex relationships
- Push people out of the fishery

Short-term Fish Declines (days, weeks, months)

- Relationship initiation
- Alter relationship power dynamics
- Negotiations of fish prices and quantities, condom use

Short-term fish decline impacts power in fish-for-sex relationships

Female fish-for-sex participant:

It is the issue of decline in fish catch that has really created all these messes. A long time ago I could go and make money at the beach so I really could depend on myself and it was really not a bother that I needed someone to stand for me in order to get fish, because fish was so many. Today, people are scrambling for fish. So I can even go as low as accepting 50KES [$0.60] from someone, or as little as just fish-for-food to go to bed with someone.

Participants balance risks of HIV and food insecurity

- **Fishery ecology** – fish catch, species, size – influence relationships' power dynamics

Participants balance risks of HIV and food insecurity

- **Fishery ecology** – fish catch, species, size – influences relationships' power dynamics

- **Environmental change** impacts human health through unexpected pathways

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How do harmful algal blooms affect:

1. Aquatic ecosystems
2. Fishers, and
3. Fish consumers

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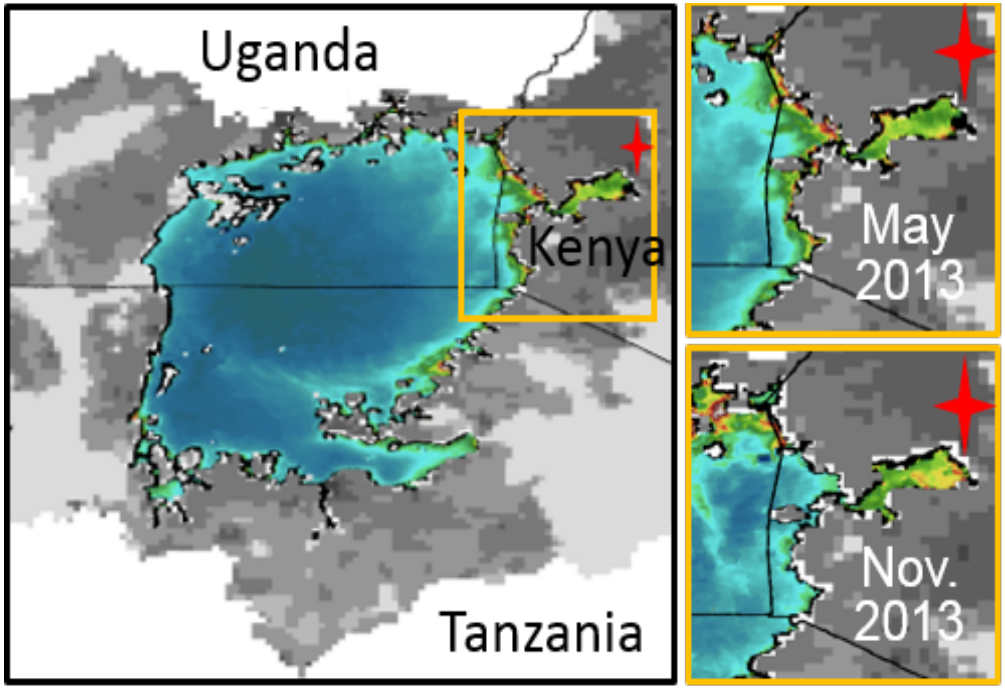
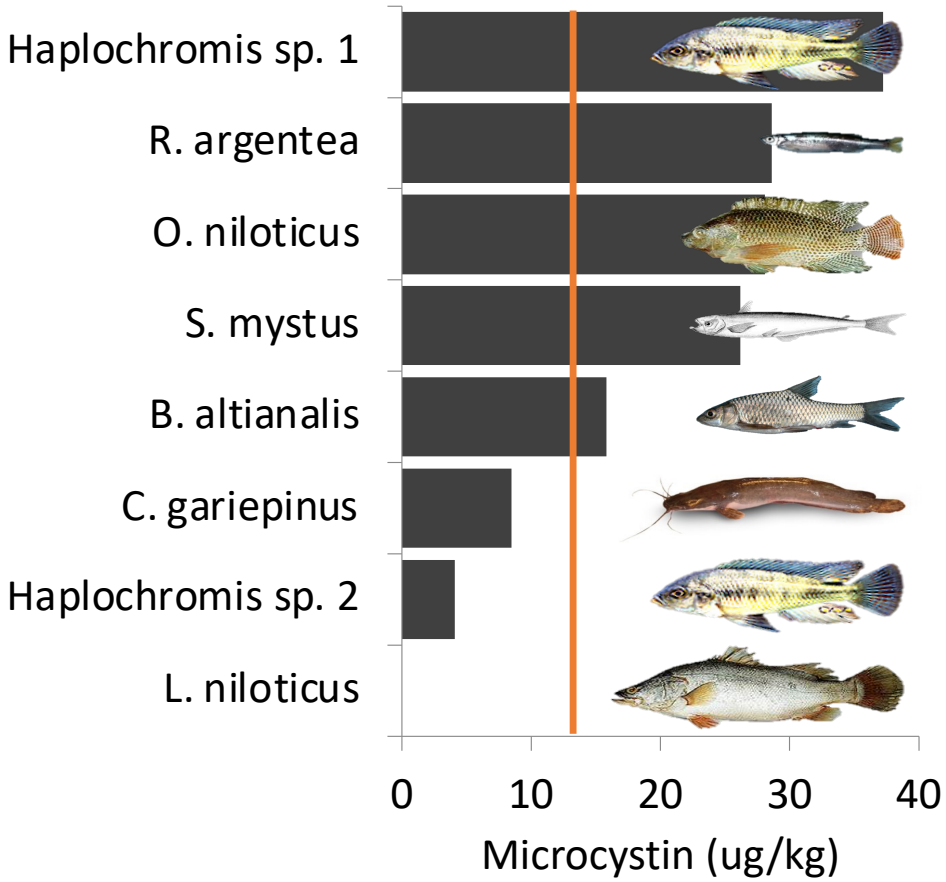


Remotely sensed images of Lake Victoria. Cold to warm scale depicts algal biomass (chlorophyll a); grey scale depicts population density. The red star is Kisumu, Kenya (pop. ~1 million).



Mean microcystin (µg/kg) in L. Victoria fish. The orange line shows when daily consumption by adults exceeds WHO provisional guidelines.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SUSTAINABLE DEVELOPMENT GOALS

Discussion Questions

- Should environmental or human health concerns be addressed first? Why?
- What can be gained from looking at the intersections between human and environmental health? What might be the drawbacks of this approach?
- “Ecosystem services” describe the ways the environment contributes to human well-being. Does the environment also have an inherent value? What are the advantages to looking at the environment through a lens of people?
- What are the challenges and inequities of having to address global environmental problems (like climate change) locally?