



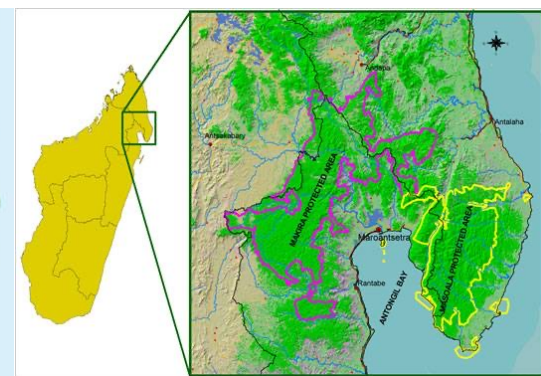
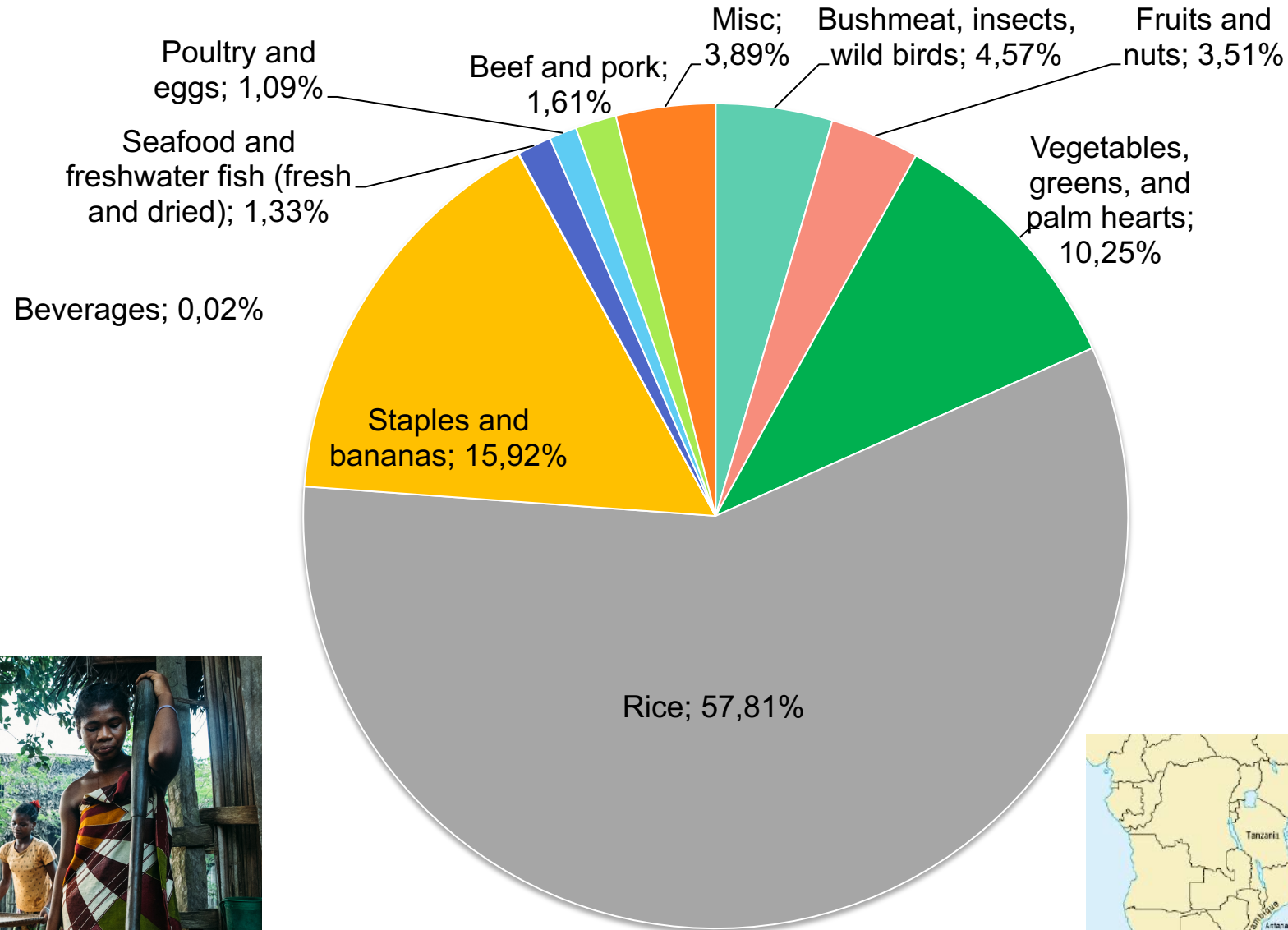
Marine conservation and nutritional resilience in the Antongil Bay, Madagascar

Christopher Golden

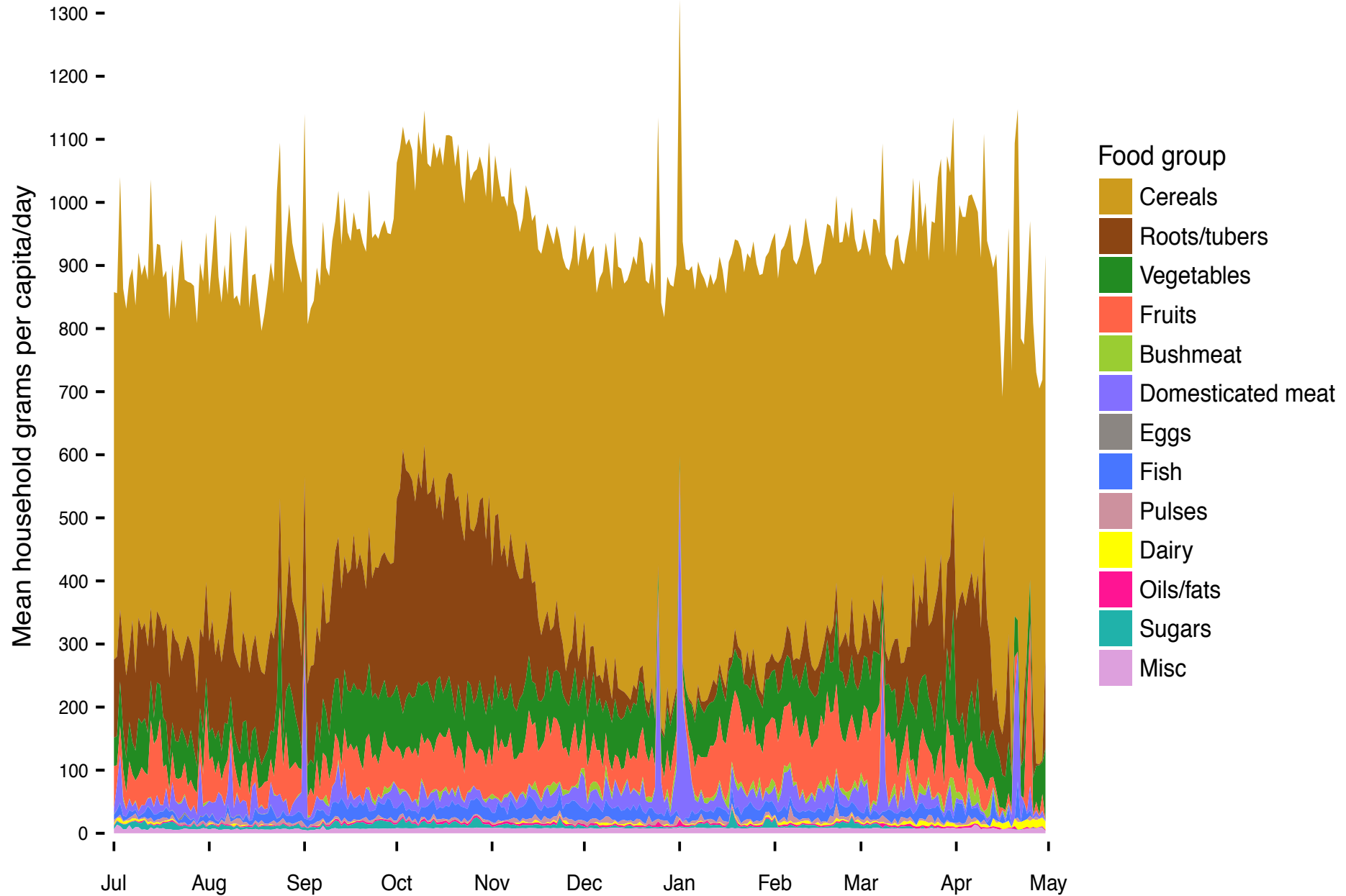
HSPH: Dept. of Nutrition; Environmental Health; Global Health & Population



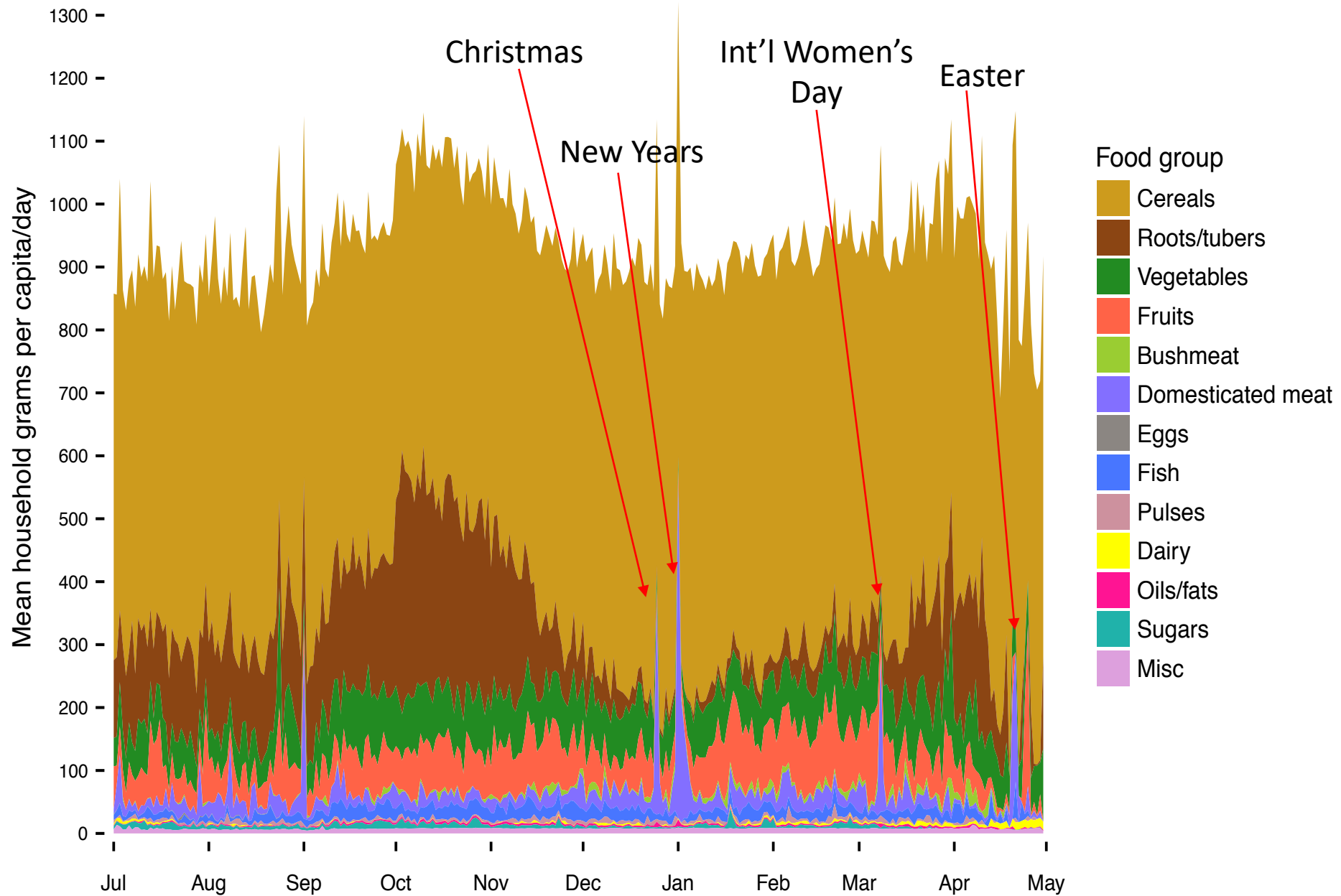
Overall Diet by Weight in Non-Coastal Rainforest Communities



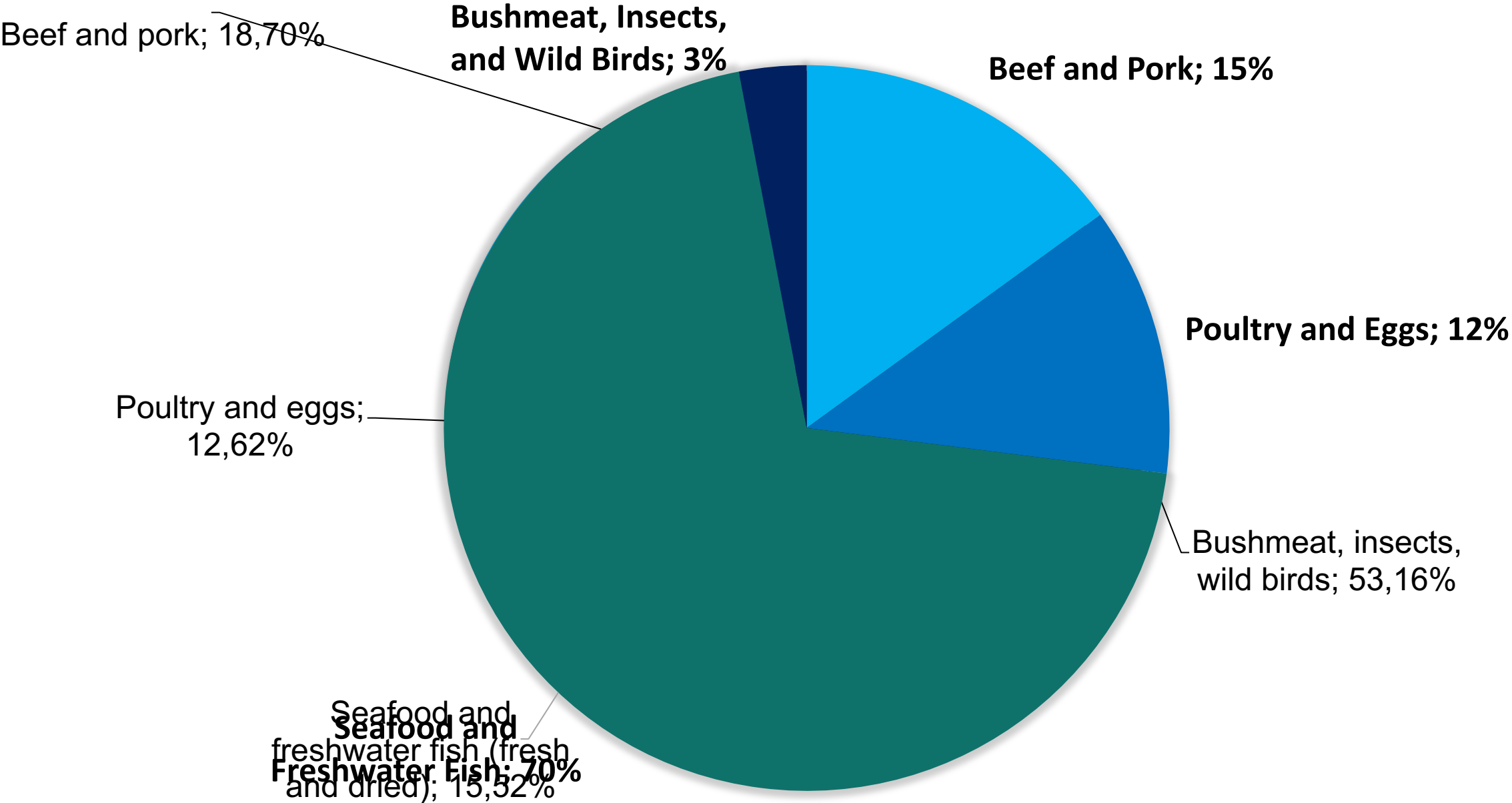
Daily Dietary Diversity in Non-Coastal Rainforest Communities



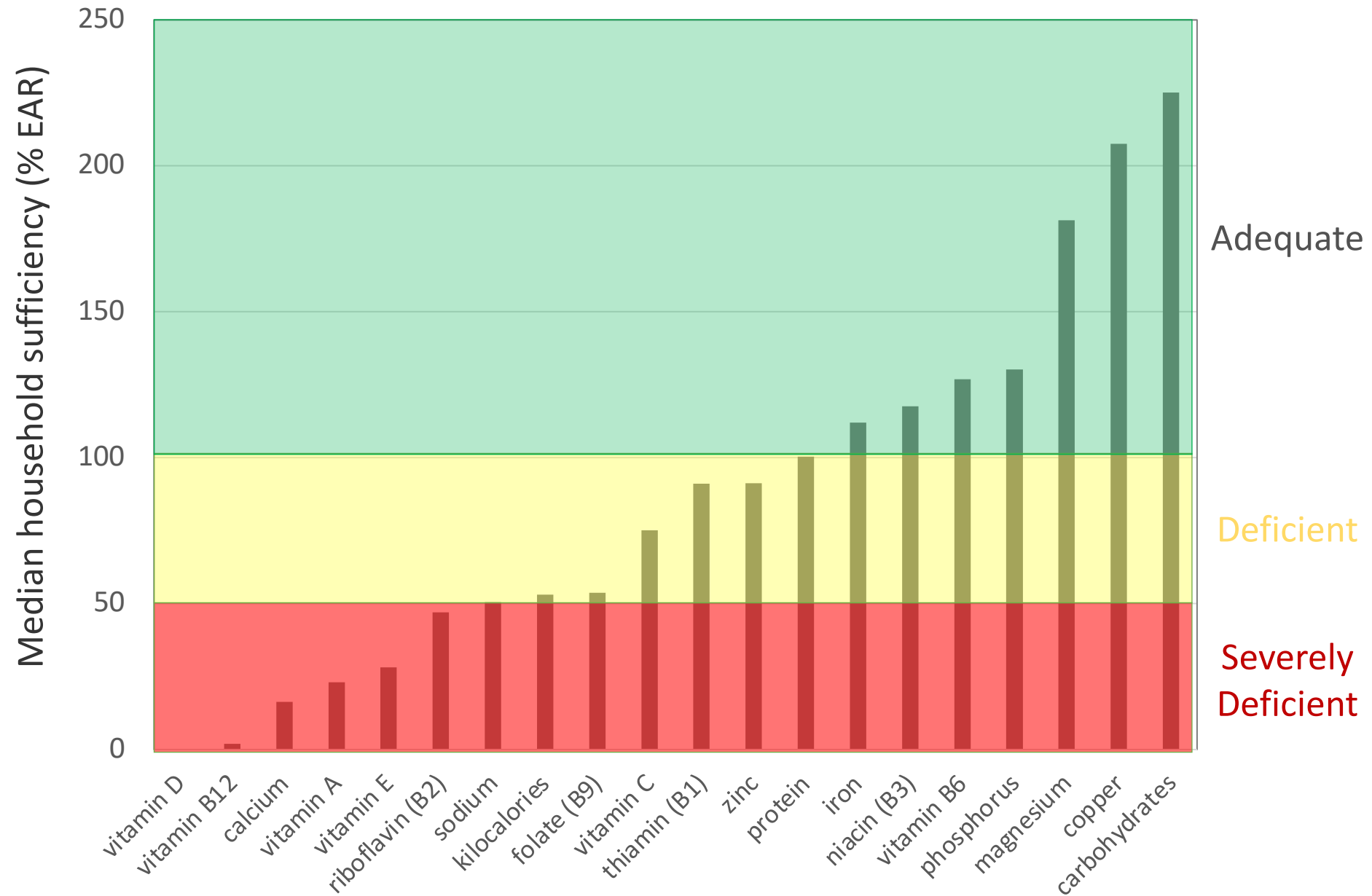
Feast days



Animal Source Foods in Non-Coastal Rainforest Communities



Estimated nutrient deficiencies based on dietary records



Study Design

- Prospective cohort study
n=5 communities; 225 households; 1009 individuals;
3 years from 2014-2017
- Weekly fish catch data
- Underwater visual census

Management systems:

Locally managed marine area (LMMA) ① ②

Traditionally managed area ③ ④

Marine National Park (MNP) ⑤



Antongil Bay

Christopher D. Golden^{1,2,3*}, Cortini Borgerson^{3,4}, Benjamin L. Rice^{3,5}, Lindsay H. Allen^{6,7},
Evelin Jean Gastá Anjanarinirina³, Christopher B. Barrett⁸, Godfred Boateng¹,
Jessica A. Gephart⁹, Daniela Hampel^{6,7}, Daniel L. Hartl⁵, Erwin Knippenberg¹⁰,
Samuel S. Myers², Dera H. Rafalason¹¹, Herlyne Ramihantaniarivo¹²,
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and Miadana Arisoa Vonona³

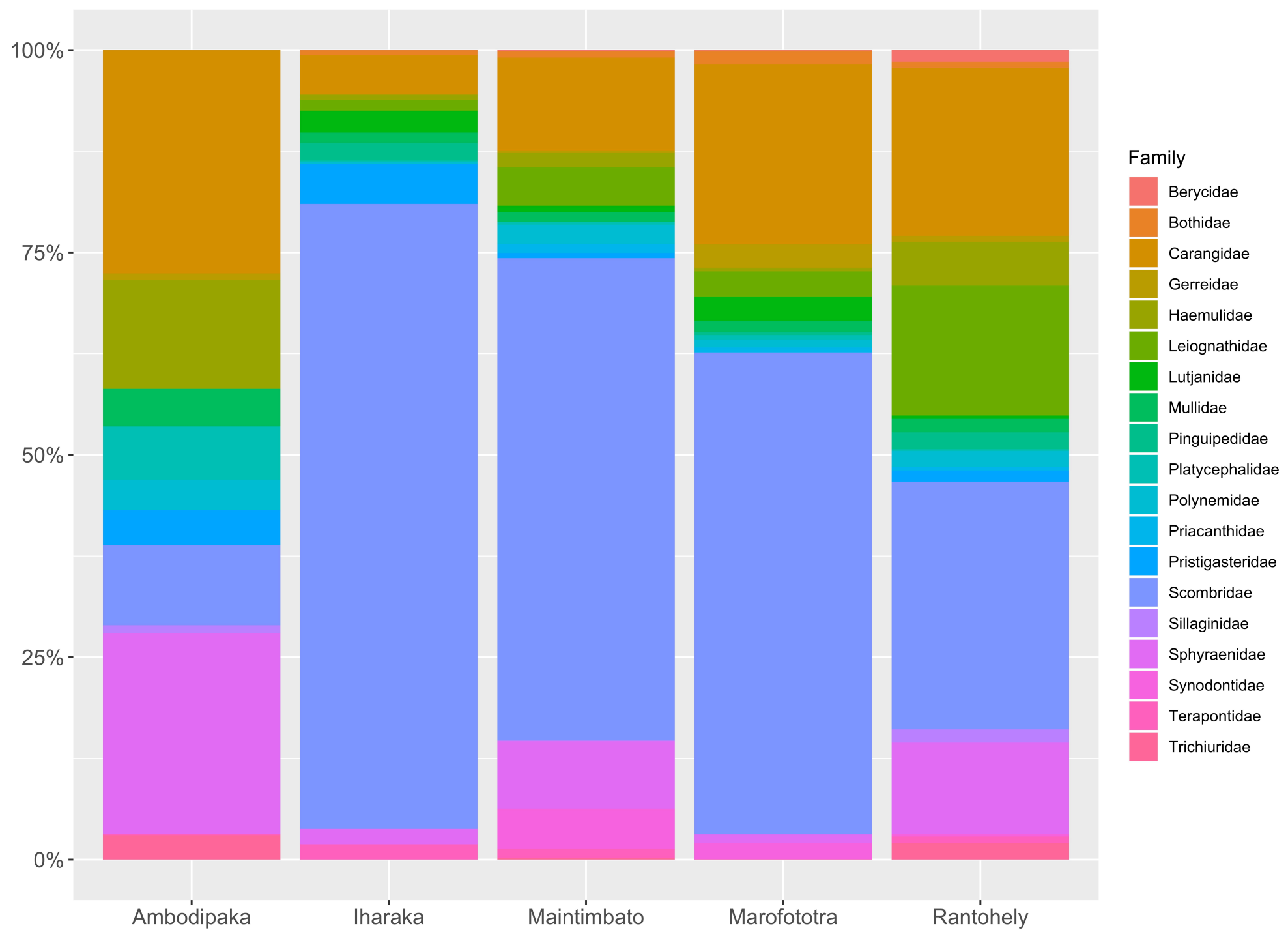
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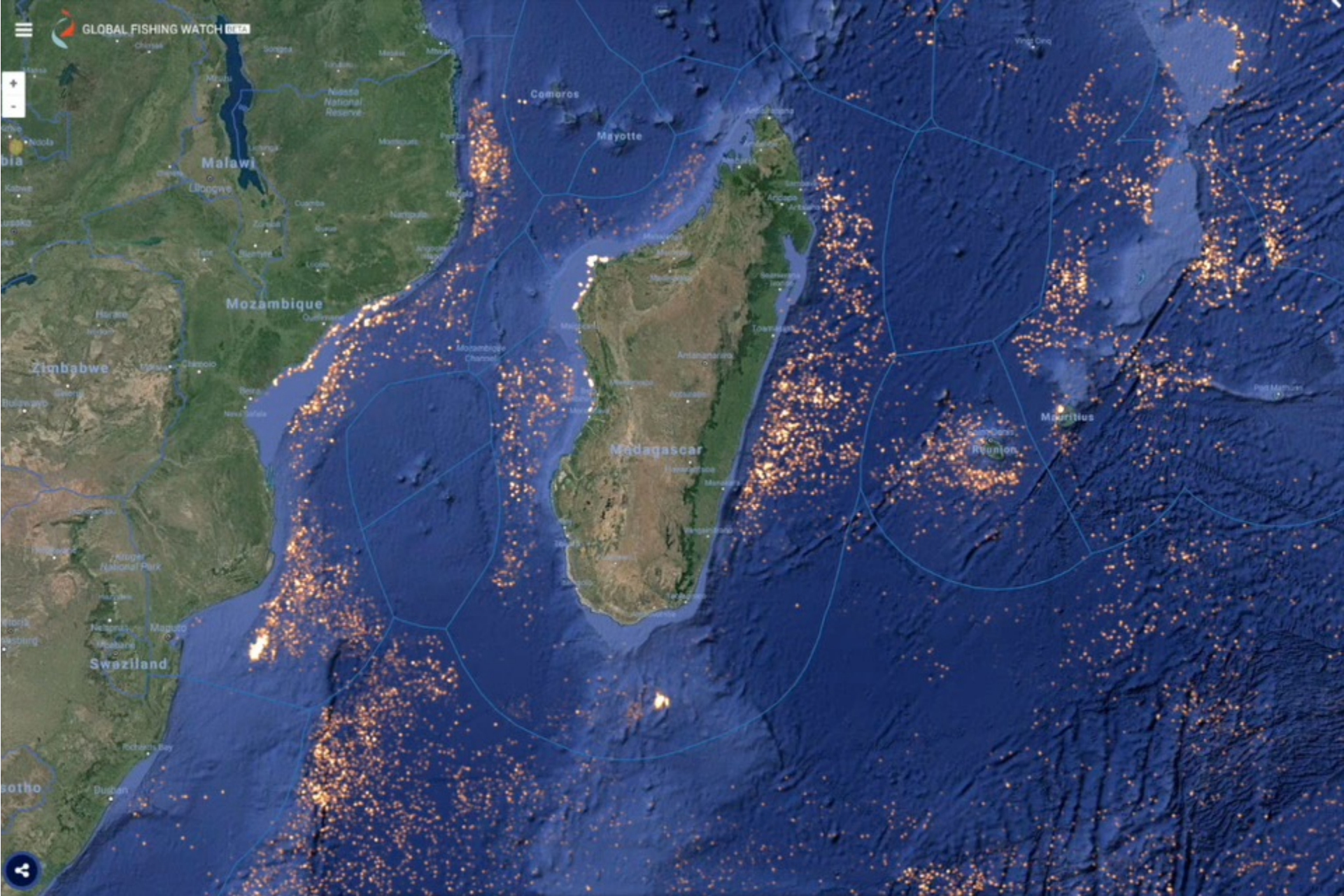
SURVEY/INTERVIEW INFORMATION	2015	2016		2017			
	Sept - Dec (Hot/Dry)	Jan - April (Hot/Wet)	May - Aug (Cold/Wet)	Sept - Dec (Hot/Dry)	Jan - April (Hot/Wet)	May - Aug (Cold/Wet)	Sept - Dec (Hot/Dry)
Dietary intake	◆	◆	◆	◆	◆	◆	◆
Direct household food observation		▲	▲	▲	▲	▲	▲
Socio-economic status	◆	◆	◆	◆	◆	◆	◆
Household fisheries activities	◆	◆	◆	◆	◆	◆	◆
Catch-per-unit effort for fishing	▲	▲	▲	▲	▲	▲	▲
Natural resource use	◆	◆	◆	◆	◆	◆	◆
Self-reported illness and treatment			●	●	●		
DIRECT ASSESSMENT/BIOLOGICAL SAMPLES							
Anthropometrics			●	●	●	●	●
Hemoglobin			●	●			
Fasting venipuncture blood samples			●	●			
Blood plasma			●	●			
Dried blood spots			●	●	●		
Malaria RDTs			●	●	●		
Thin blood smears			●	●			
Fecal samples			●	●			
Fingernail samples					●		
Micronutrient nutrition analysis			●	●			
Intestinal parasite evaluation			●	●			
Mercury analysis					●		

Weekly ▲

Monthly ◆

At clinical visits ●





19 DEC 2013 + - 20 JUN 2014

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
			2014									

183 days -30.4676, 59.0845

Other environmental threats to fishery production and catch

A global analysis of coral bleaching over the past two decades

S. Sully¹, D.E. Burkepile^{2,3}, M.K. Donovan³, G. Hodgson⁴ & R. van Woesik¹

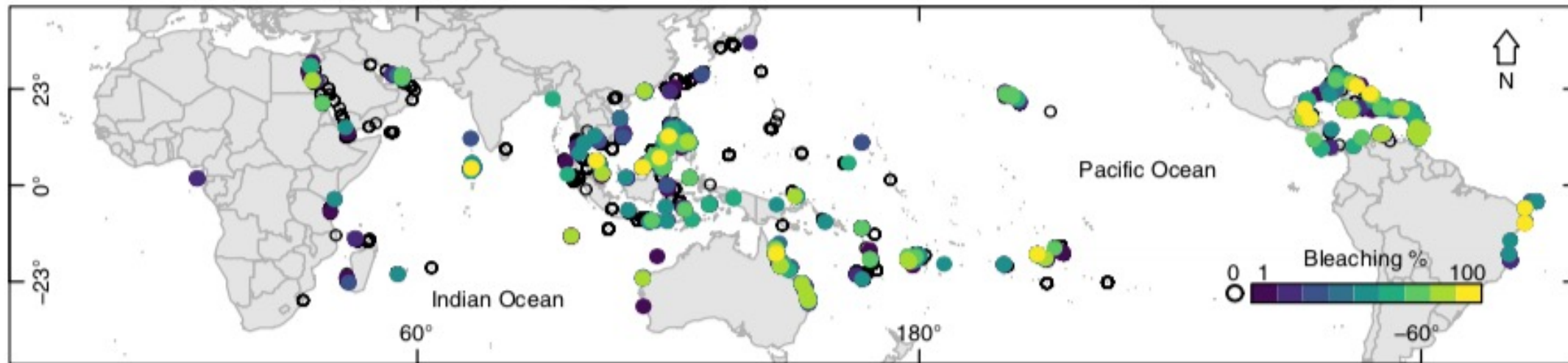
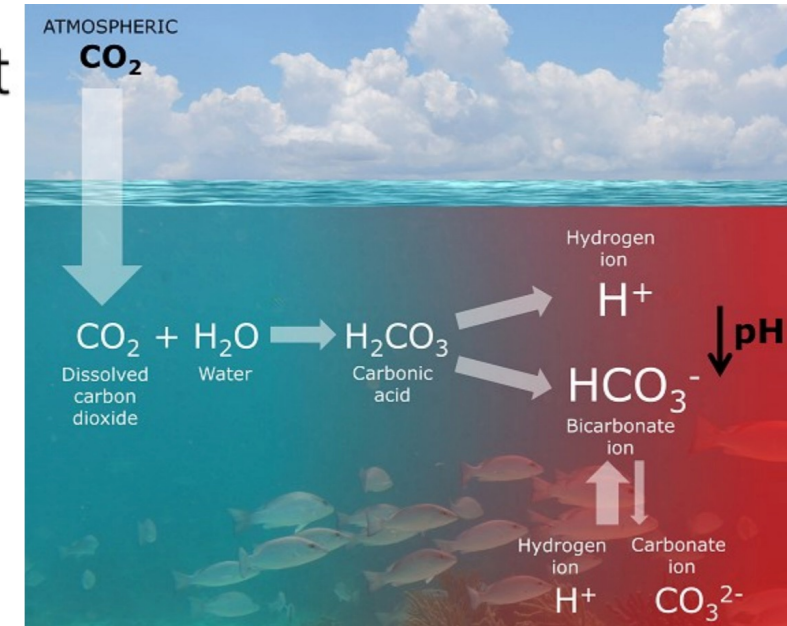
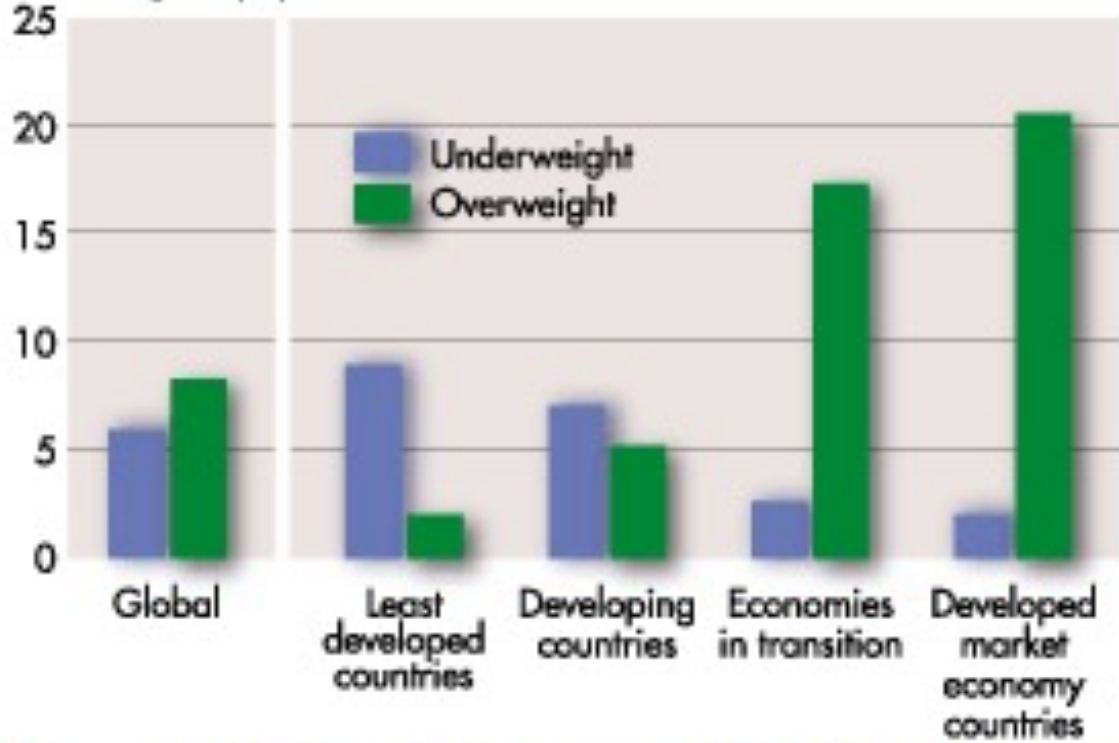


Fig. 1 Coral bleaching distribution. Prevalence of coral bleaching presented as a percentage of the coral assemblage that bleached at survey, measured at 3351 sites in 81 countries, from 1998 to 2017. White circles indicate no bleaching. Colored circles indicate 1% bleaching (blue) through 100% bleaching (yellow)

Nutrition Transition

From least to most developed countries:
overweight is on the rise

Percentage of population

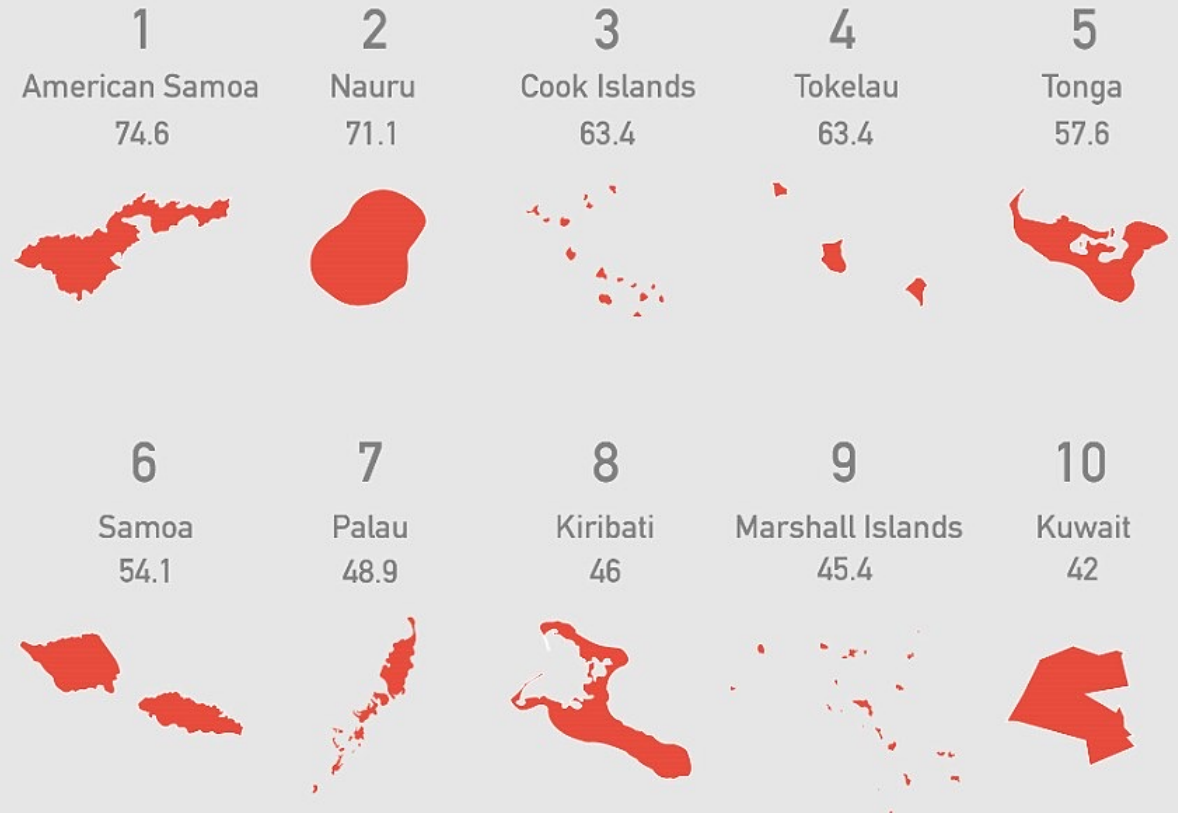


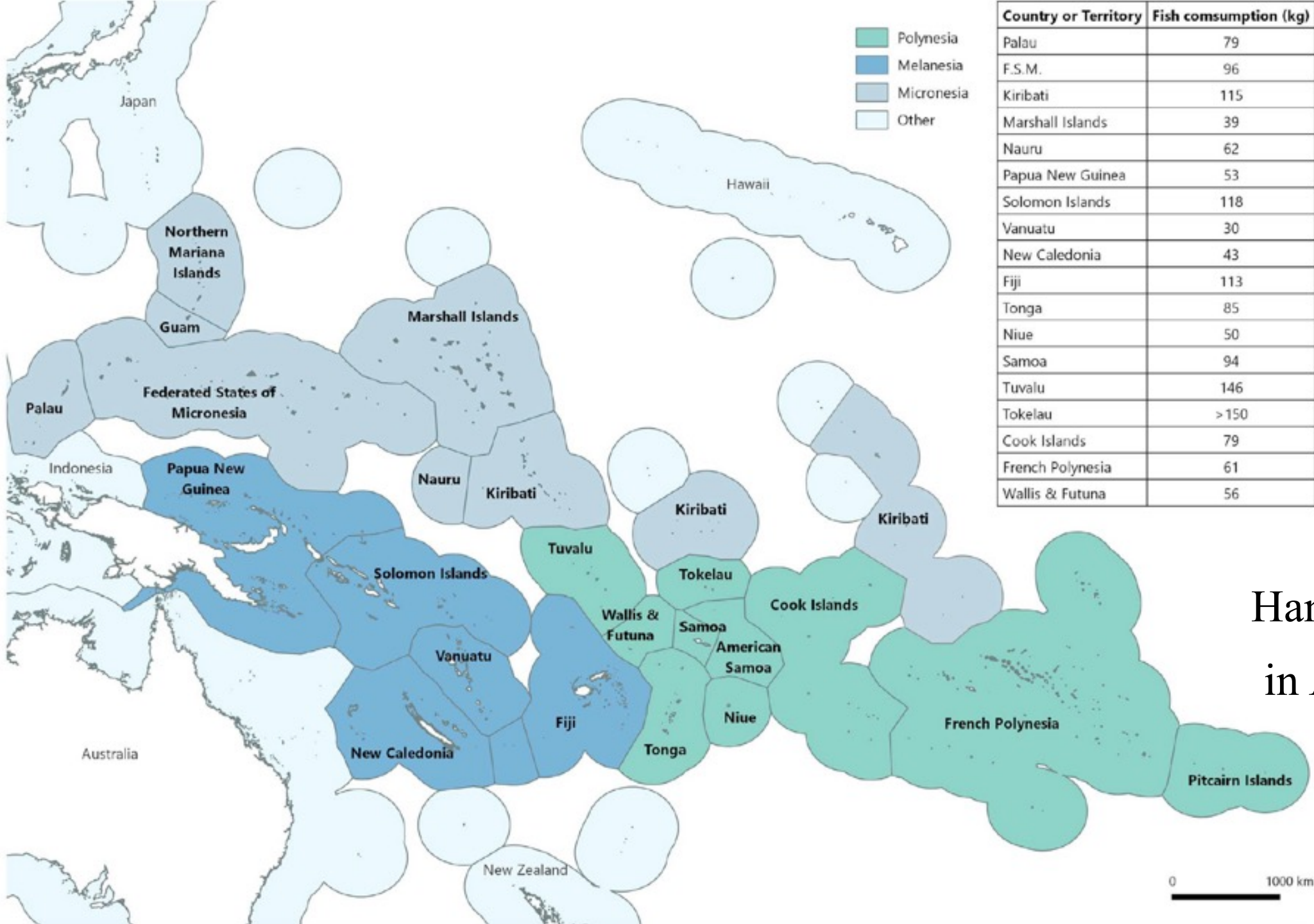
As countries develop, they face many of the problems common in industrialized nations. Obesity is one of the most worrisome.

Source: WHO, 2000.

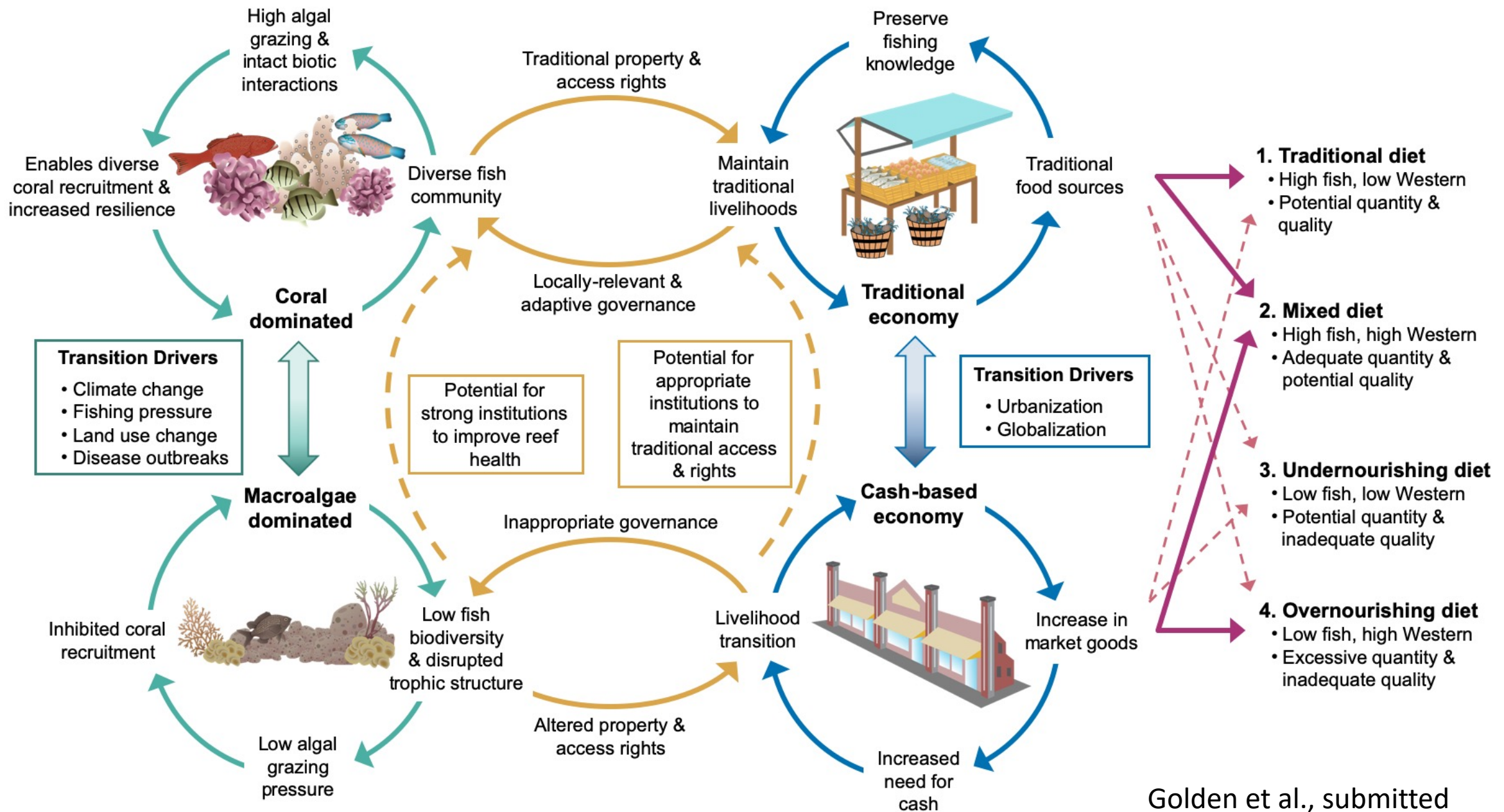
Top 10 Most Obese Nations (%)

Not to scale





Hanich et al. 2018
in *Marine Policy*



Ecological transitions



- Climate change
- Overfishing
- Land-use change
- Disease outbreaks

Market and cultural transitions

II.

Every day of the life he led after he remembers
that pile of food taller
than any building he had ever seen

he remembers it as he slices spam, sizzling
hot on the pan, he remembers it
as he drizzles soy sauce
into a boiling pot of crispy ramen

he remembers it as he pops
open a can of vienna sausage, savors
the salty grease on his warm rice, the taste
of a filled belly

III.

And even after
his breathing
turned heavy
even after his joints
protested the walk to the store
even after the devious tingle trickled
into his arms, even after
the doctors
told him the leg

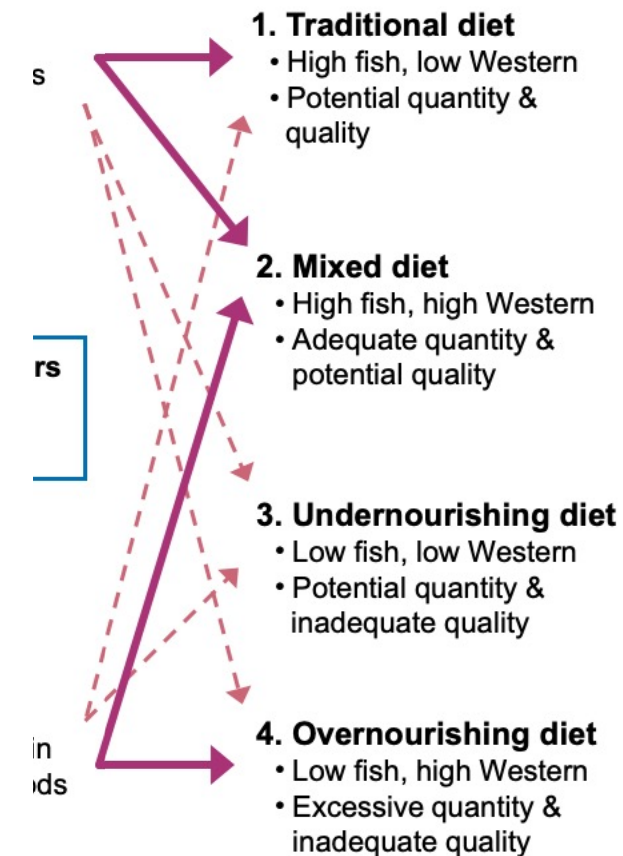
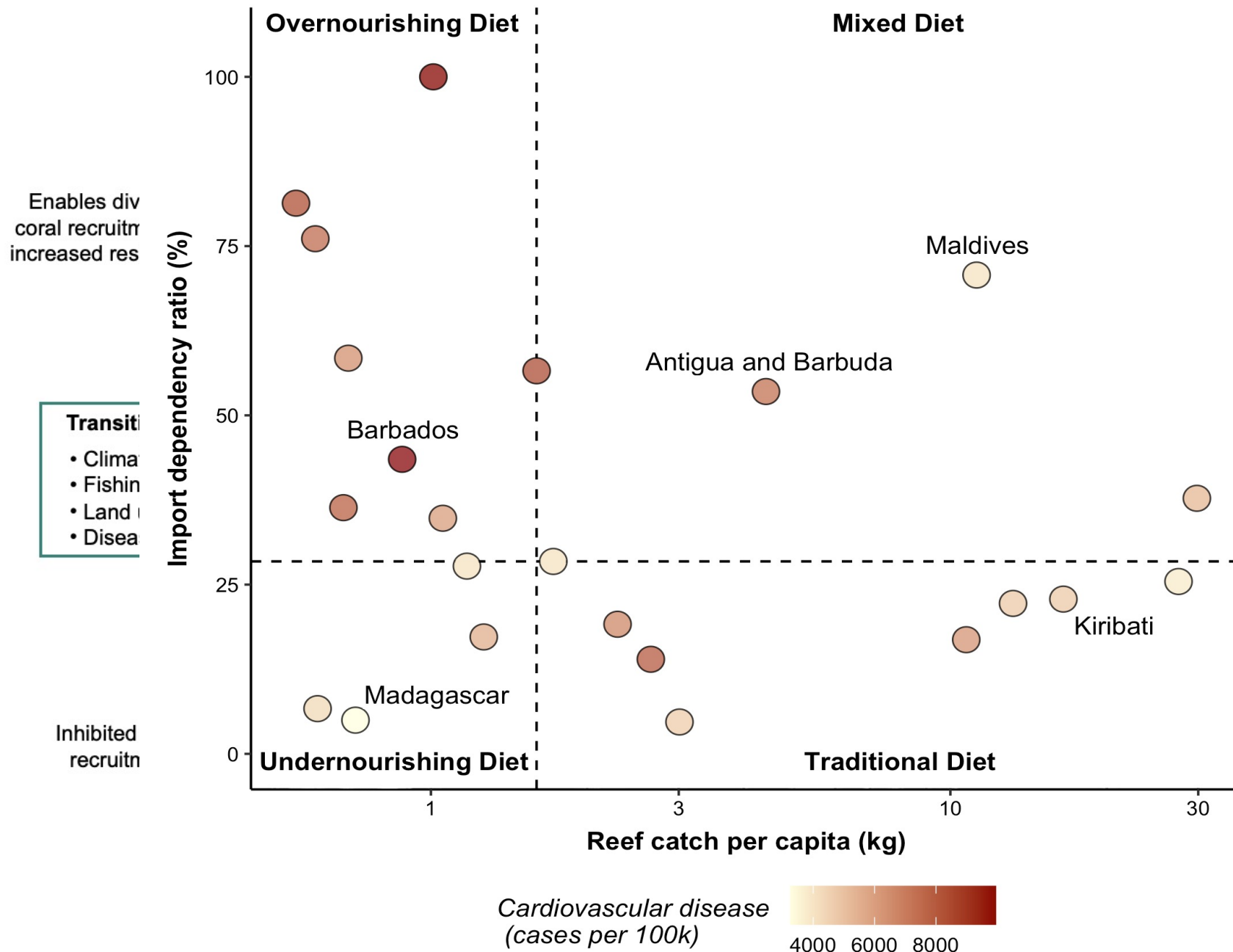
would have to go,
even then

he never
stopped
licking the grease
from his fingers
that still felt haunted
by the outlawed

hook.

Iep Jaltok:

Poems from a Marshallese
Daughter by Kathy Jetñil-
Kijiner



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