

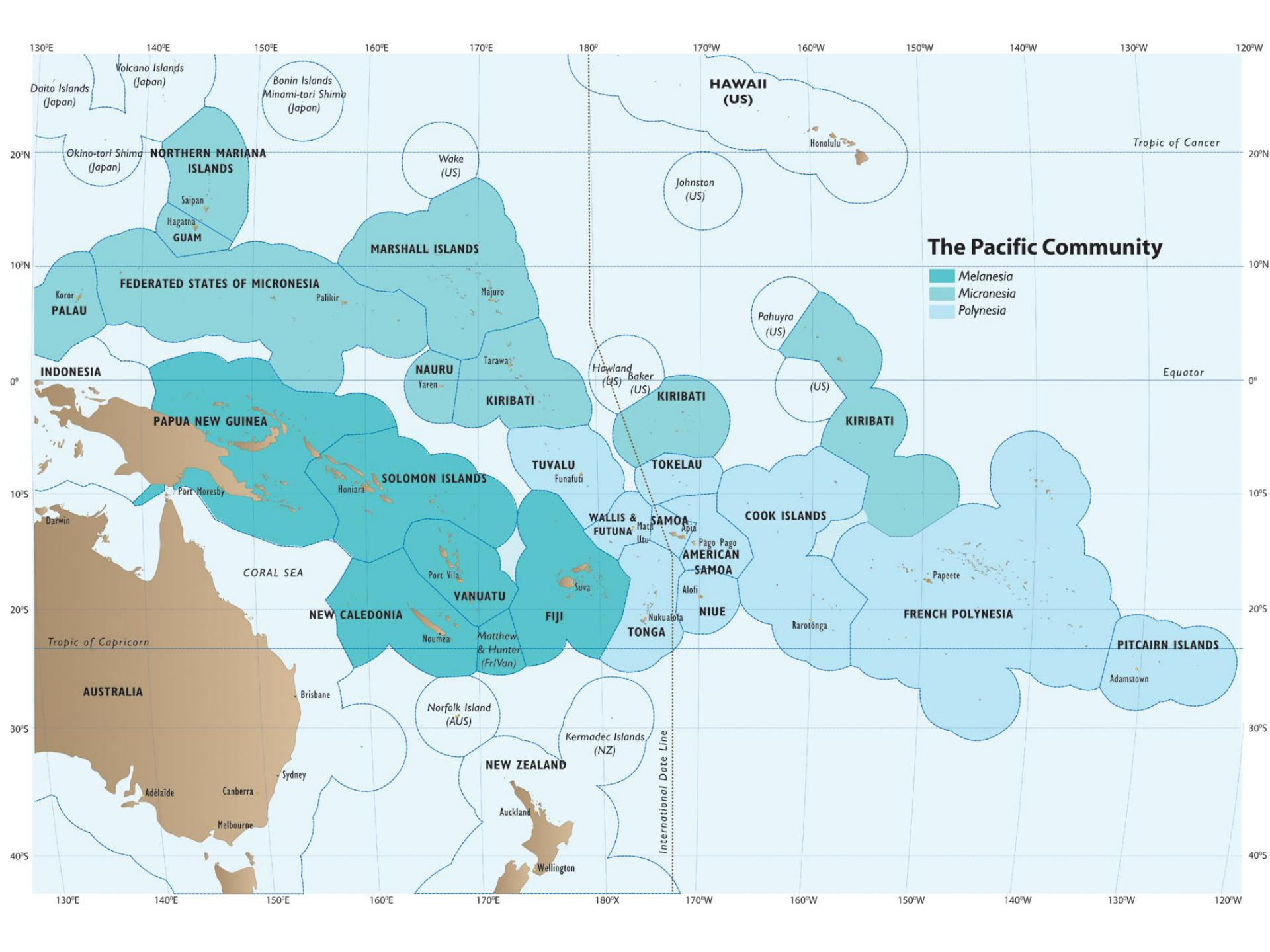

Climate change, fisheries and aquaculture in the Pacific:

Adaptations for food security, livelihoods & economic growth*

Johann Bell

SPC Secretariat of the Pacific Community

* Based on presentation made at ICES/PICES/FAO Symposium of the 'Climate change effects on fish and fisheries', Sendai, Japan, April 2010


The Pacific Community
Melanesia
Micronesia
Polynesia
HAWAII (US)
Honolulu
Tropic of Cancer
Johnston (US)
Wake (US)
Volcano Islands (Japan)
Daito Islands (Japan)
Bonin Islands Minami-tori Shima (Japan)
Okino-tori Shima (Japan)
NORTHERN MARIANA ISLANDS
Saipan
Hagatna
GUAM
MARSHALL ISLANDS
Majuro
FEDERATED STATES OF MICRONESIA
Palikir
Koror
PALAU
INDONESIA
NAURU
Yaren
Tarawa
KIRIBATI
Howland (US)
Baker (US)
KIRIBATI
Pahuyra (US)
(US)
KIRIBATI
Equator
PAPUA NEW GUINEA
Port Moresby
SOLOMON ISLANDS
Honiara
TUVALU
Funafuti
TOKELAU
WALLIS & FUTUNA
Mata Utu
SAMOA
Apia
COOK ISLANDS
Pago Pago
AMERICAN SAMOA
Darwin
CORAL SEA
Port Vila
VANUATU
Suva
FIJI
Alofi
NIUE
Papeete
NEW CALEDONIA
Noumea
Nukualofa
TONGA
Rarotonga
FRENCH POLYNESIA
Tropic of Capricorn
Matthew & Hunter (Fr/Van)
PITCAIRN ISLANDS
Adamstown
AUSTRALIA
Brisbane
Norfolk Island (AUS)
Kermadec Islands (NZ)
NEW ZEALAND
Sydney
Adelaide
Canberra
Melbourne
Auckland
Wellington
International Date Line
130°E
140°E
150°E
160°E
170°E
180°
170°W
160°W
150°W
140°W
130°W
120°W
20°N
10°N
0°
10°S
20°S
30°S
40°S

Outline

- Role of fisheries and aquaculture in the lives of the people of the Pacific Community
- Plans to maintain the benefits of fisheries in the face of key drivers
- Vulnerability of these plans to climate change
- How best to adapt

Vulnerability of Fisheries and Aquaculture in the Pacific to Climate Change

Our approach

Projected changes to atmospheric and oceanic conditions

↓

Ecosystems supporting fish

↓

Fish stocks

↓

Implications for food security, livelihoods and economic growth

↓

Adaptations needed to maintain productivity - management and policies

Australian Government
AusAID

Multi-model mean from 13 ‘Coupled Model Intercomparison Project III’ models used for IPCC AR-4

Our approach

Projected changes to atmospheric and oceanic conditions

↓

Ecosystems supporting fish

↓

Fish stocks

↓

Implications for food security, livelihoods and economic growth

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Adaptations needed to maintain productivity - management and policies

Australian Government
AusAID

70 contributors from 30 institutions

- Alfred-Wegener-Institute, Germany
- Australian Institute of Marine Science
- CSIRO
- CLS, Satellite Oceanography Division, France
- C20 Consulting, Australia
- Danish Meteorological Institute
- Forum Fisheries Agency
- Great Barrier Reef Marine Park Authority
- IFREMER
- Institut de Recherche pour le Developpement
- James Cook University
- LSCE, IPSL, Paris, France
- Network of Aquaculture Centres for Asia -Pacific
- NOAA
- Papua New Guinea National Fisheries Department
- Secretariat of the Pacific Community
- Service de la Peche French Polynesia
- Snowy Mountains Engineering Corporation
- SOPAC
- Solomon Islands Ministry of Fisheries
- SPREP
- The WorldFish Center
- University of Hawaii
- University of Auckland
- University of New South Wales
- University of Queensland
- University of Singapore
- University of Tasmania
- Vanuatu Fisheries Department
- Virginia Institute of Marine Science, USA
- Western Australia Department of Fisheries

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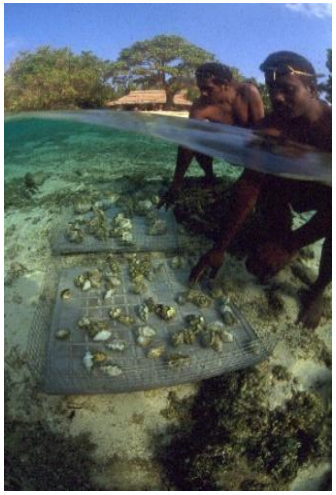
Editors: Johann Bell, Johanna Johnson, Alistair Hobday

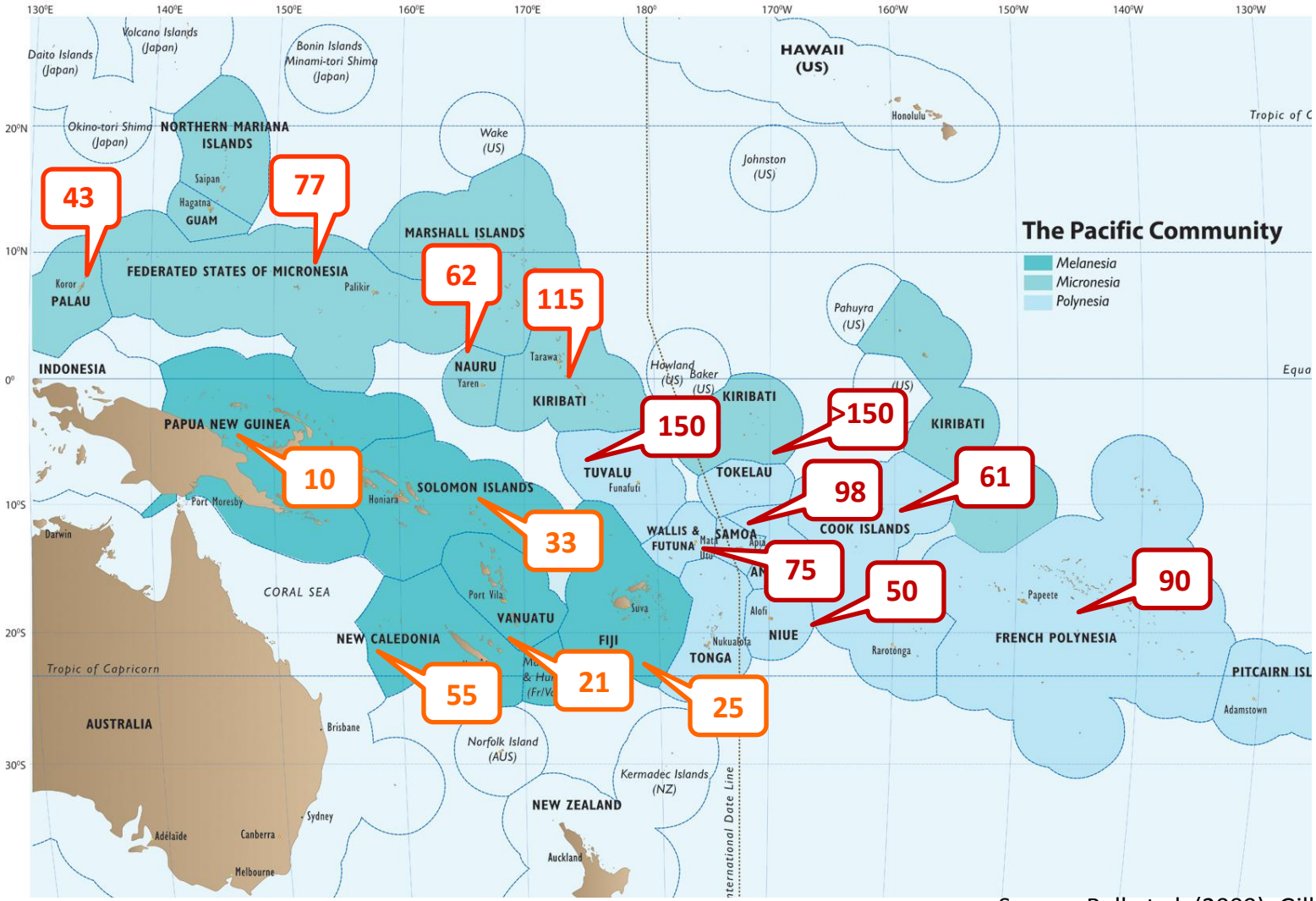
1. Roles of fisheries and aquaculture



- Food security
- Livelihoods
- Economic growth and government revenue

Food security

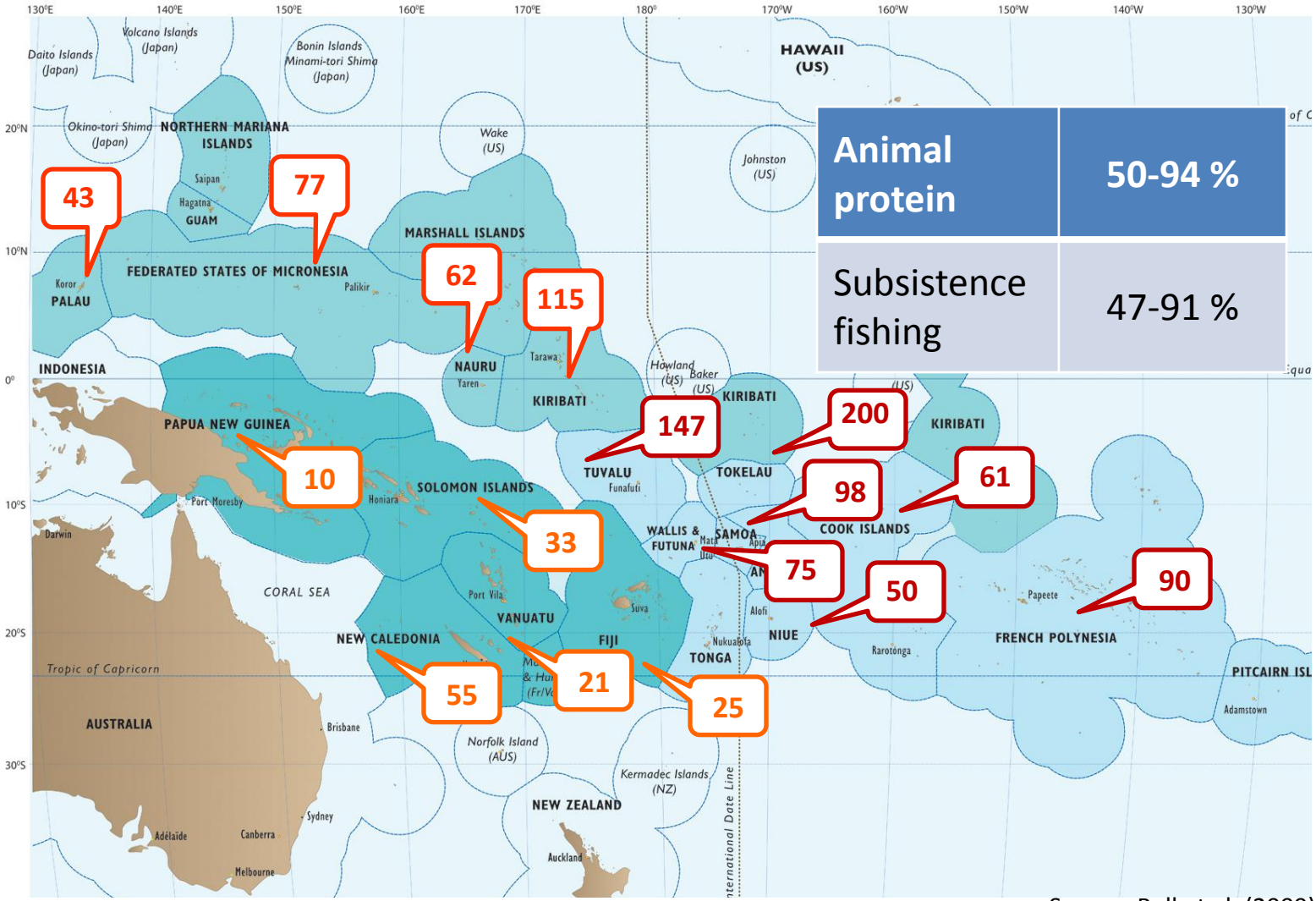
- Per capita fish consumption - rural (kg)



Source: Bell et al. (2009); Gillett (2009)

Food security

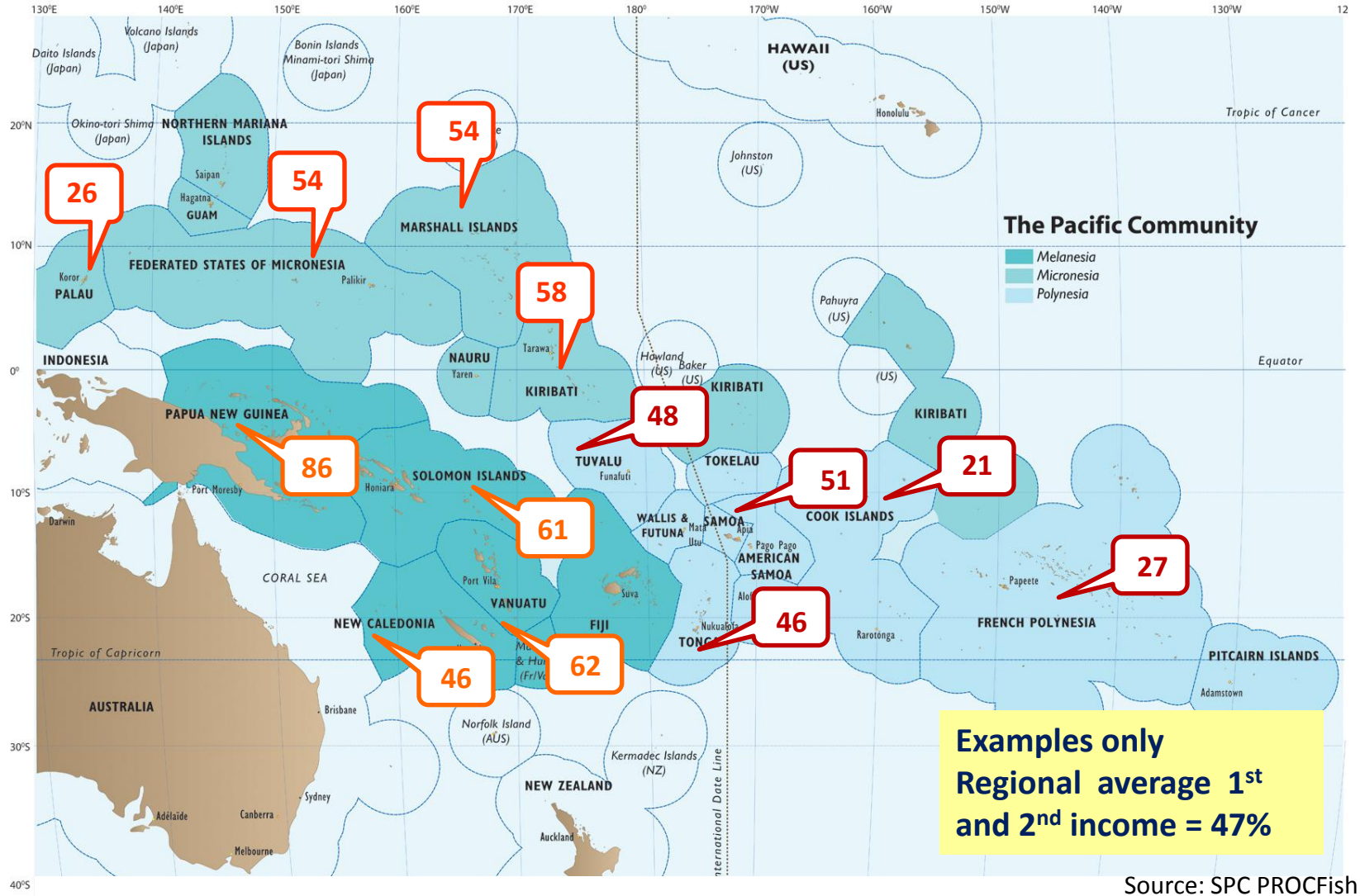
- Per capita fish consumption - rural (kg)



Source: Bell et al. (2009); Gillett (2009)

Livelihoods

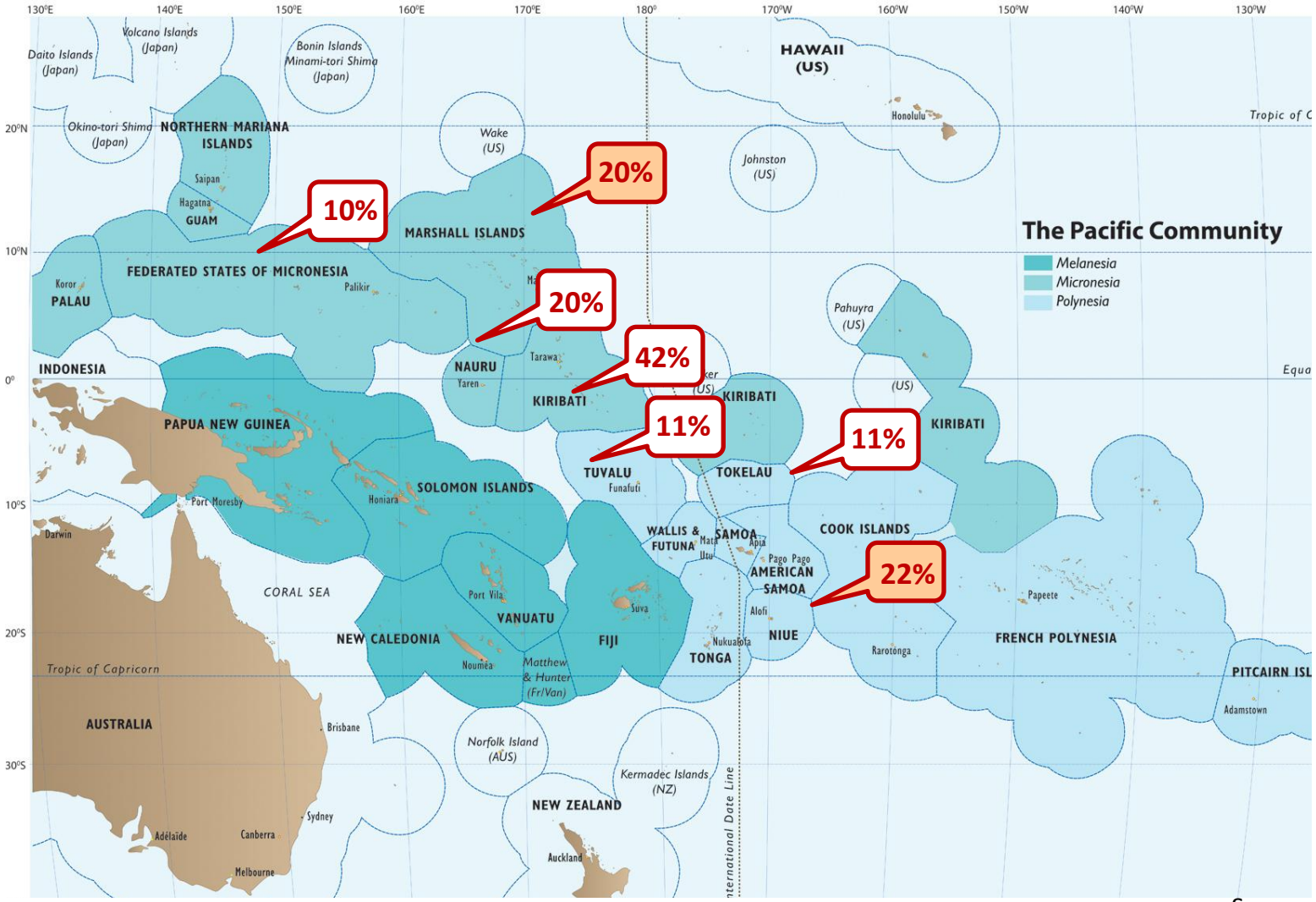
- Coastal households selling fish (%)



Source: SPC PROCFish Project

Economic contributions

- Government revenue ▭ GDP ▭



Source: Gillett (2009)

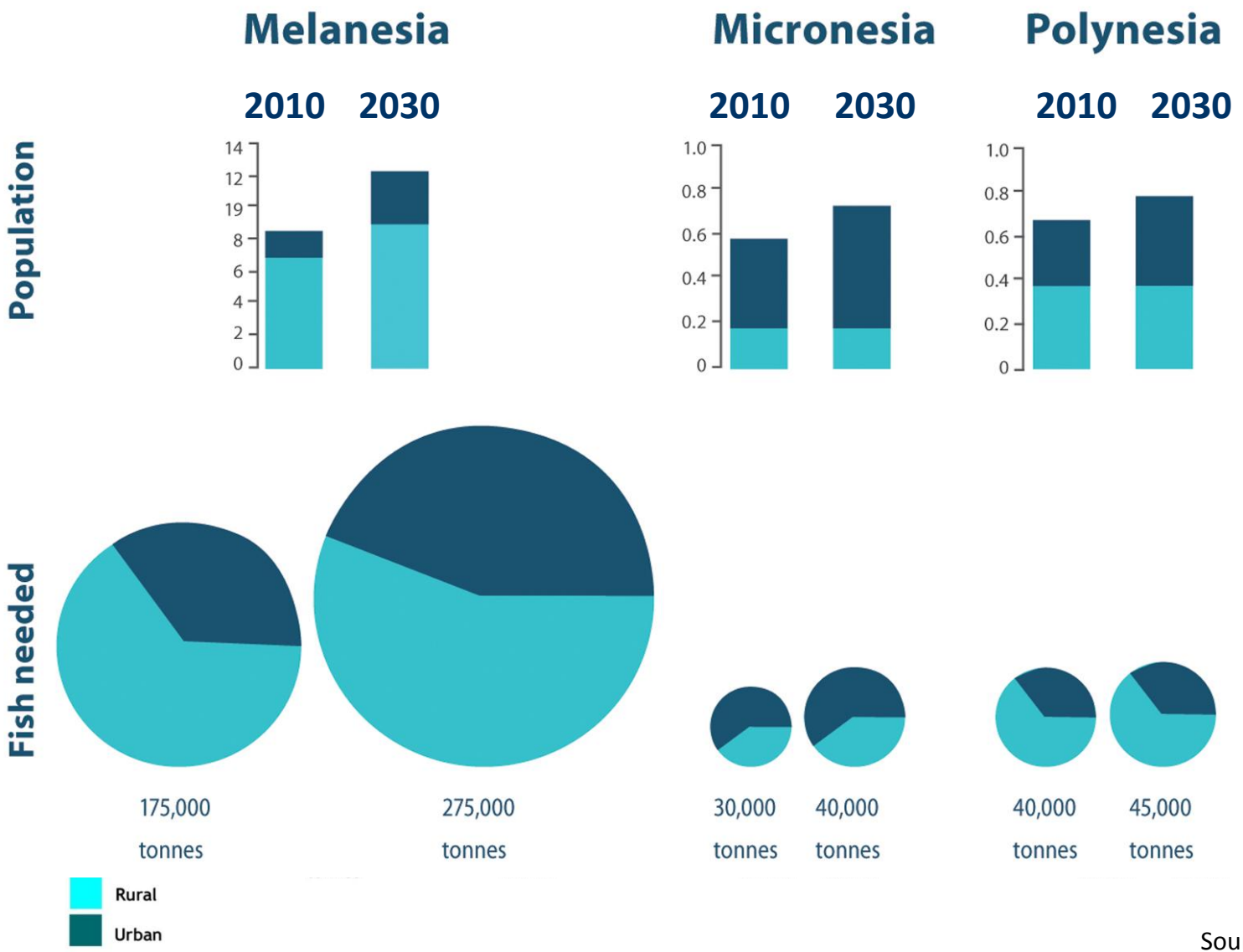
2. Plans to maintain benefits

How much fish will be needed for future food security?

How many livelihoods can fish resources and aquaculture sustain?

How can tuna best contribute to economic growth and government revenue?

Food security



Source: SPC (2008)

Livelihoods

- Domesticate tuna operations - every 100,000 tonnes landed in the region creates 10,000 jobs

Tuna catch from the Western and Central Pacific Ocean (2007)

1,727,000 mt

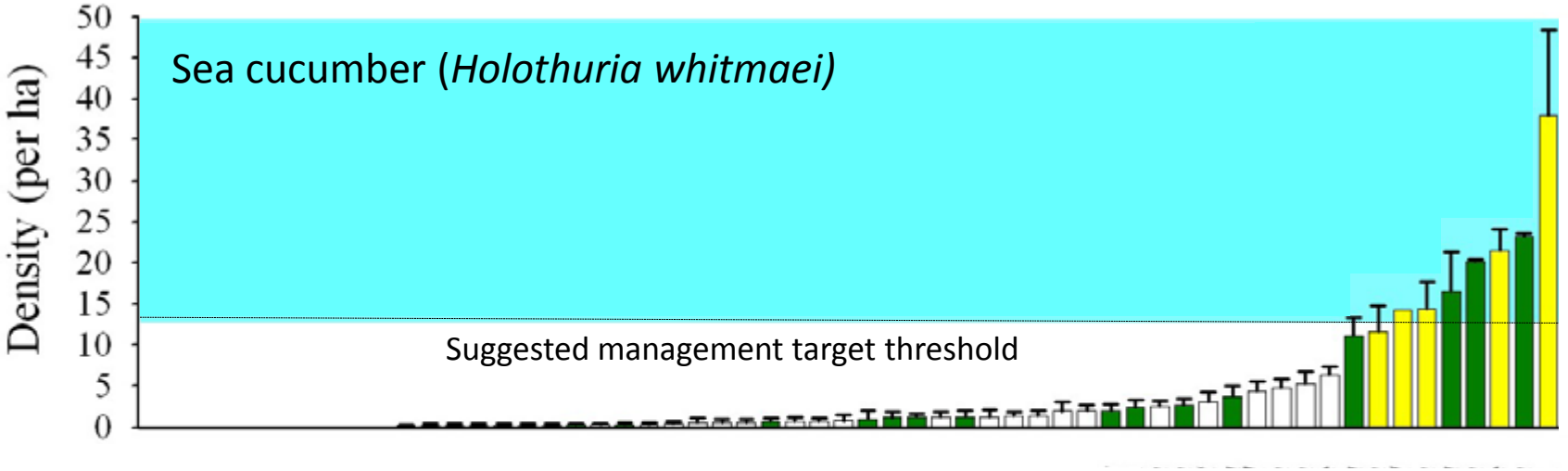
432,000 mt

143,000 mt

95,000 mt

Livelihoods

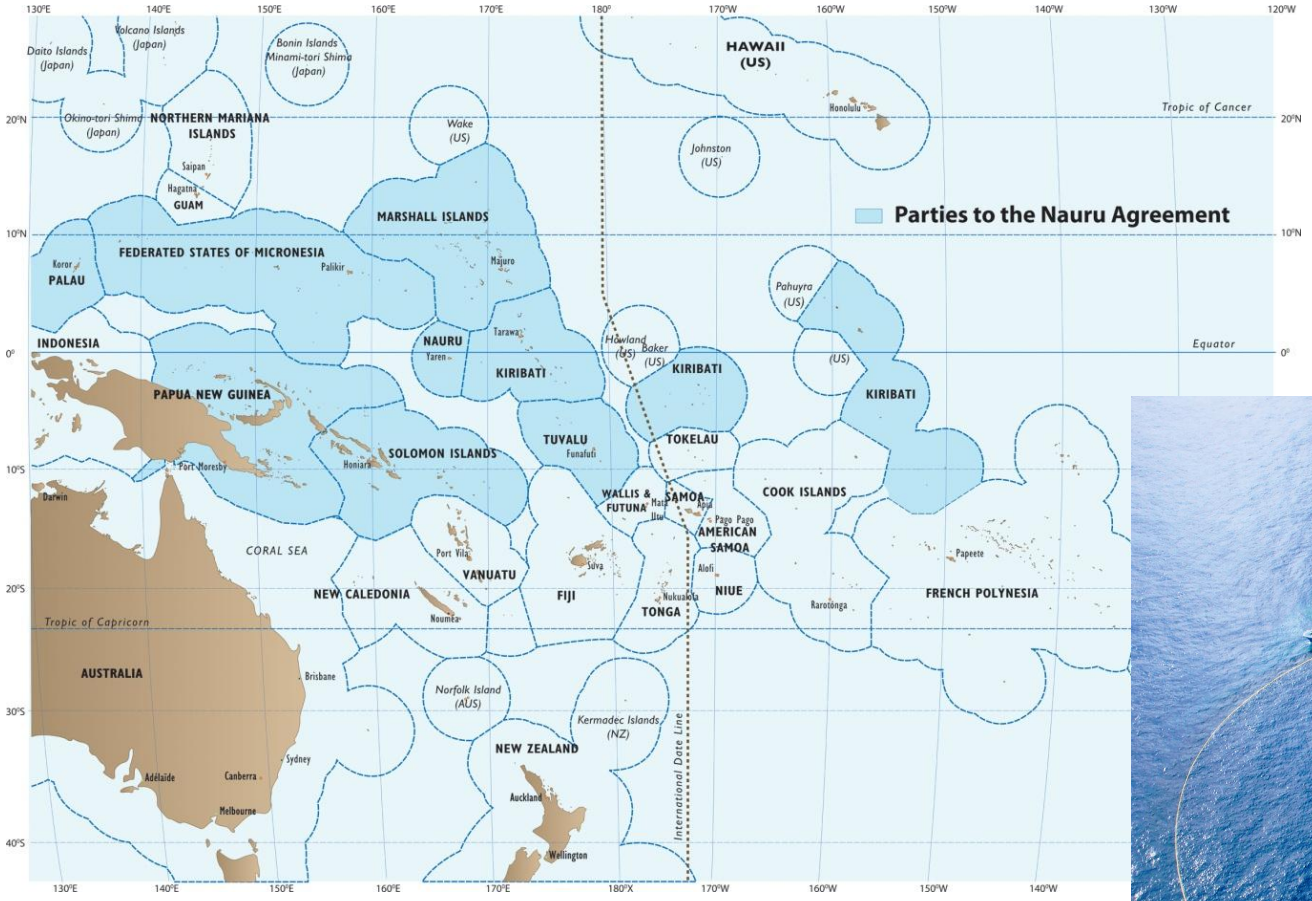
- Restore fisheries for export commodities



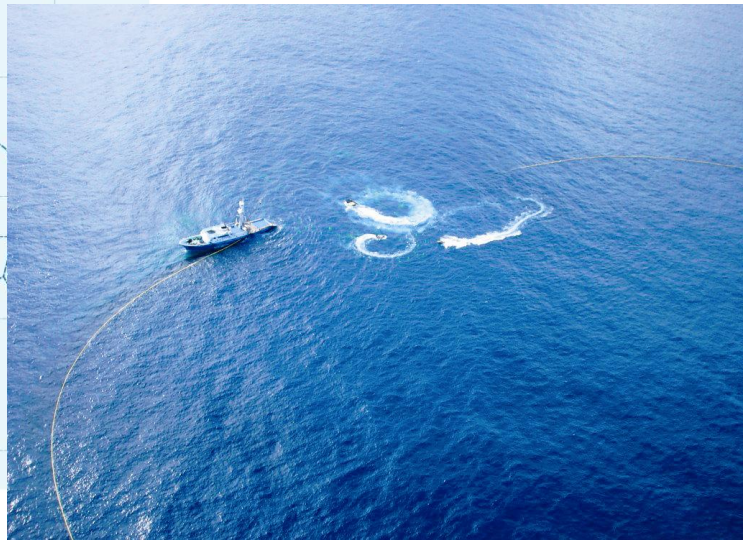
Sites across the Pacific

Government revenue

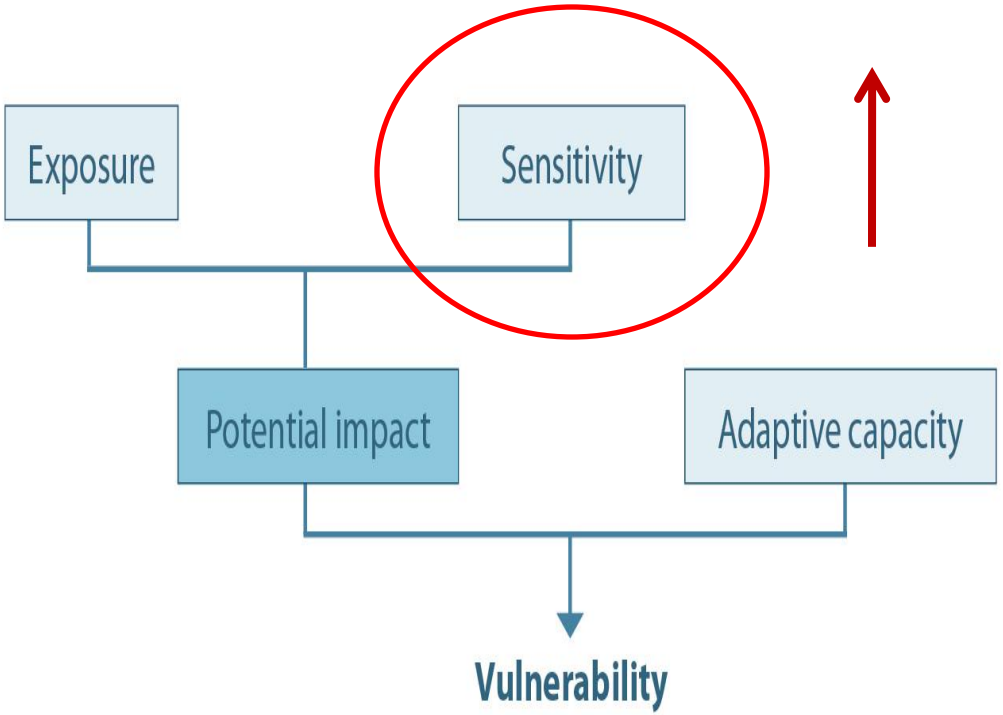
- PNA members have 25% of world's tuna resources and plan to bargain collectively for higher fees



Average 7% of 'destination' value of fish



3. Vulnerability of Pacific Community to changes in fisheries resources



Source: Adapted from D. Schroter and the ATEAM consortium 2004,

Vulnerability of Pacific Community to changes in fisheries resources

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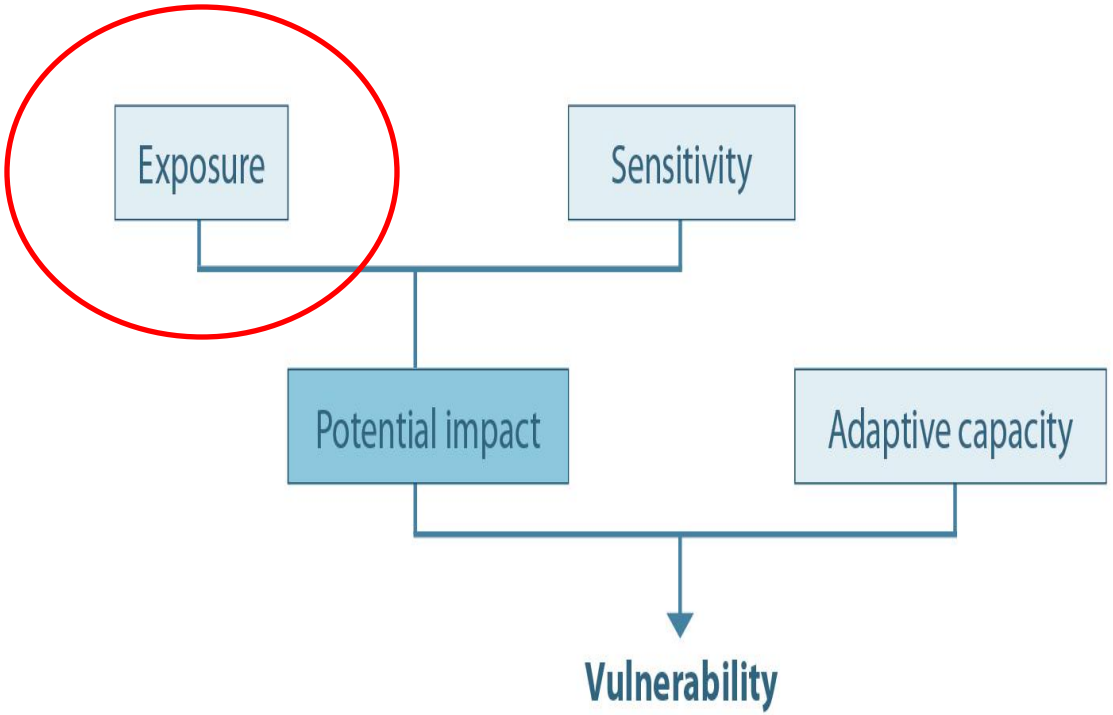


Source: Adapted from D. Schroter and the ATEAM consortium 2004,

Key drivers of change

(Future of Pacific Fisheries Study - 2010)

- **Population growth and urbanisation**
- Governance and political stability
- Global economic conditions
- Status of fisheries in other oceans
- **Climate change**
- Markets and trade
- Fuel costs
- Technology and innovation
- Foreign aid

Population growth and urbanisation

Population	2010	2035	Change
Rural	7,447,753	9,998,975	34 %
Urban	2,413,735	5,007,625	107 %
Total	**9,861,488**	**15,006,600**	**52 %**

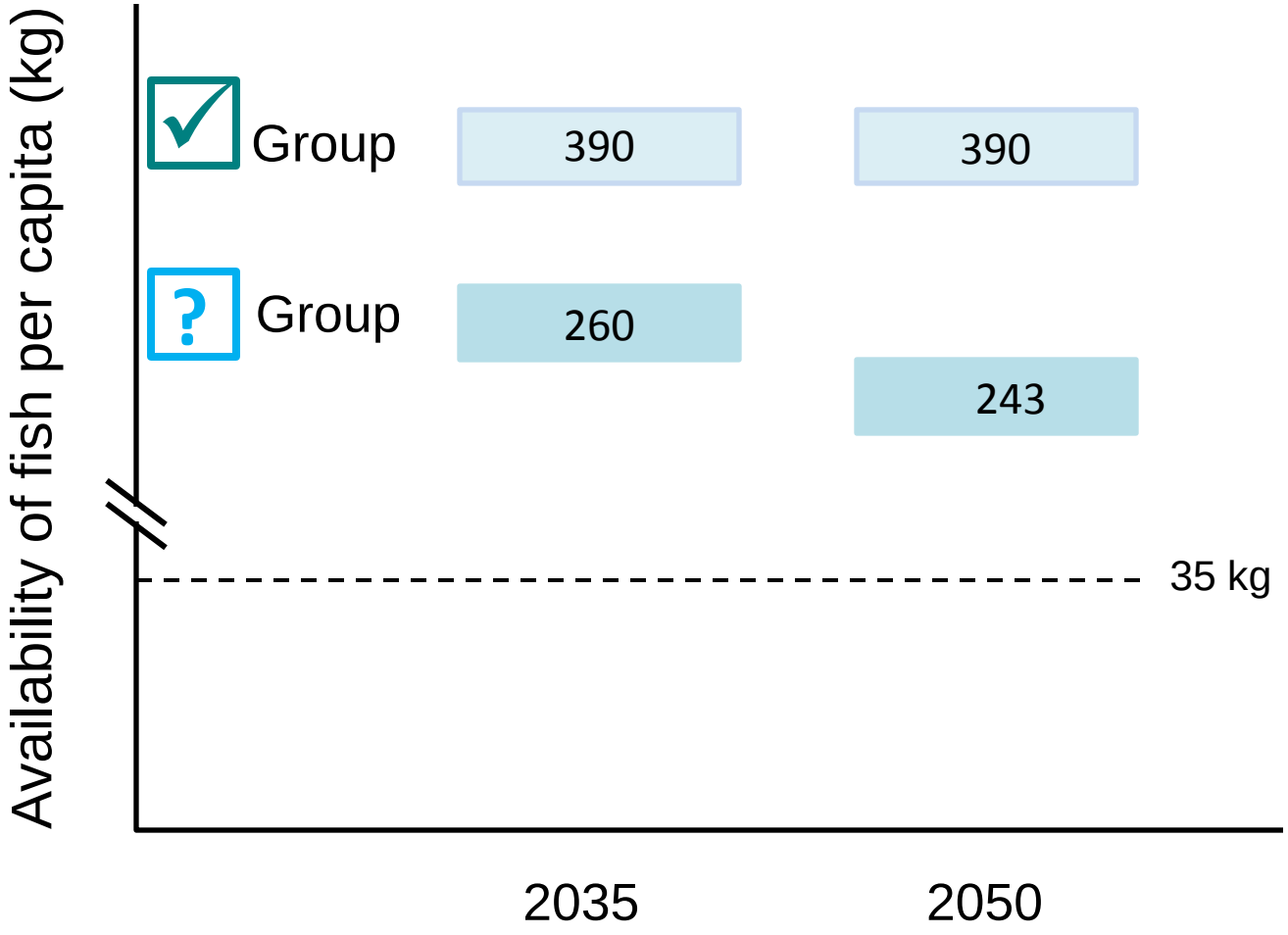
Vulnerability of plans for food security

- Fish available from coastal fisheries

  Based on 3 tonnes of fish per square km of reef (Newton et al. 2007)

Sustainable production EXPECTED to meet future needs	Sustainable production NOT EXPECTED to meet future needs	Sustainable production ADEQUATE but distribution difficult
☑	☒	?
Cook Islands	American Samoa	Kiribati
Marshall Islands	CNMI	FSM
New Caledonia	Fiji	French Polynesia
Palau	Guam	Niue
Pitcairn Islands	Nauru	Tonga
Tokelau	Papua New Guinea	Tuvalu
	Samoa	Wallis and Futuna
	Solomon Islands	
	Vanuatu	

Vulnerability of plans for food security



Vulnerability of plans for food security

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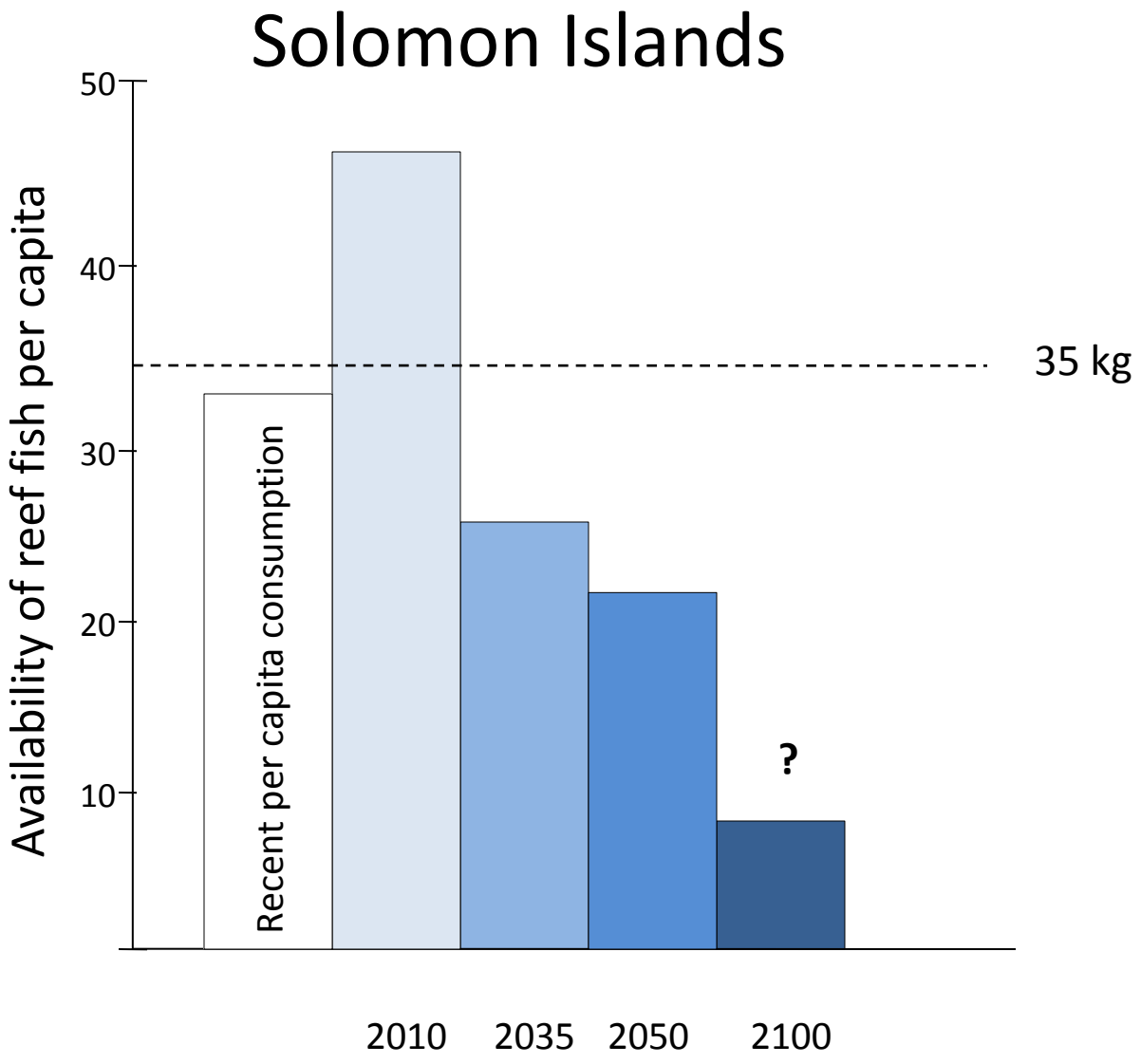
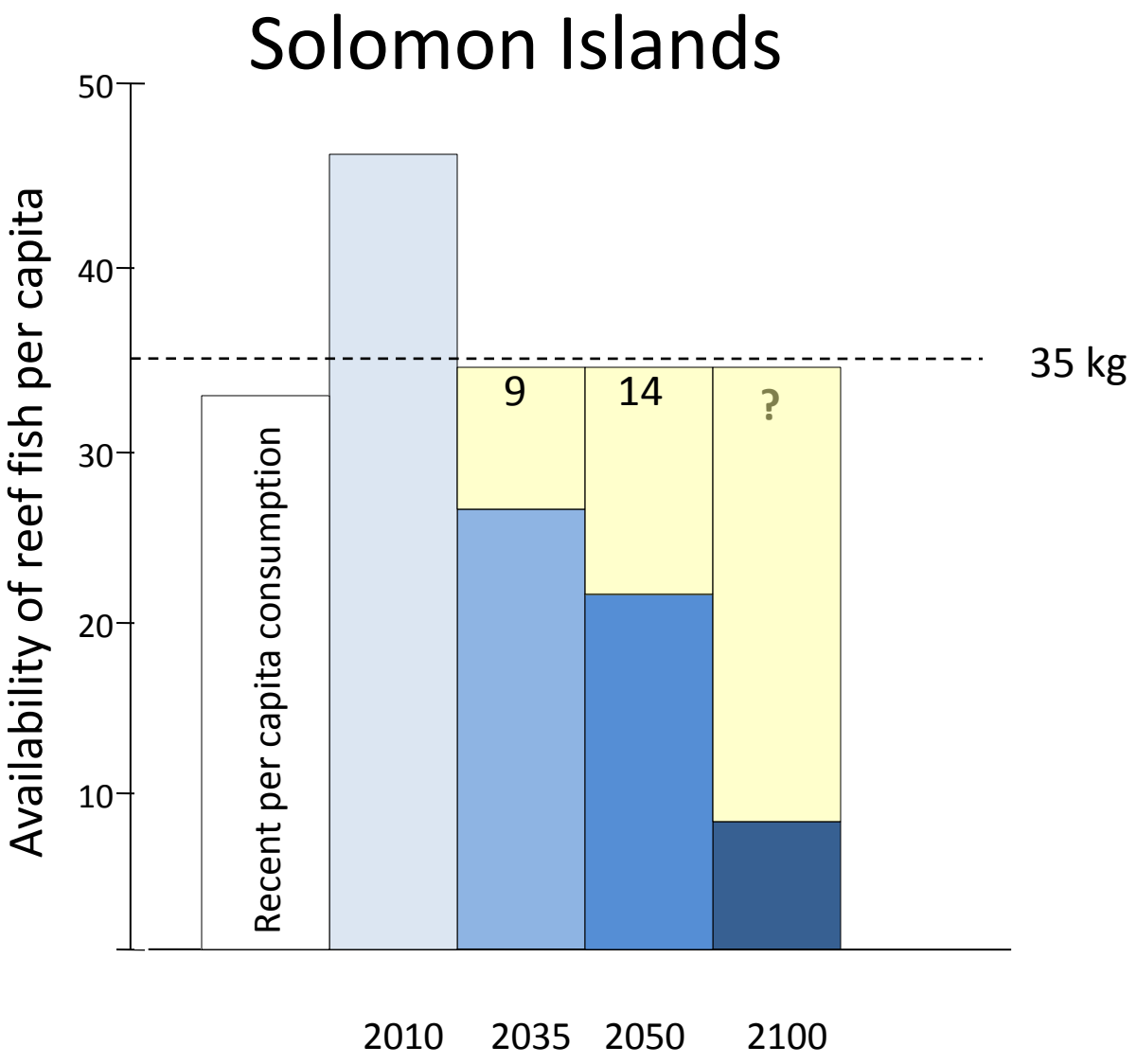
Tokelau	Papua New Guinea	Tuvalu
	Samoa	Wallis and Futuna
	Solomon Islands	
	Vanuatu	

Effects of population growth



Year	Population
2010	549,000
2035	969,900
2050	1,245,800

Gap to be filled



Year	Population
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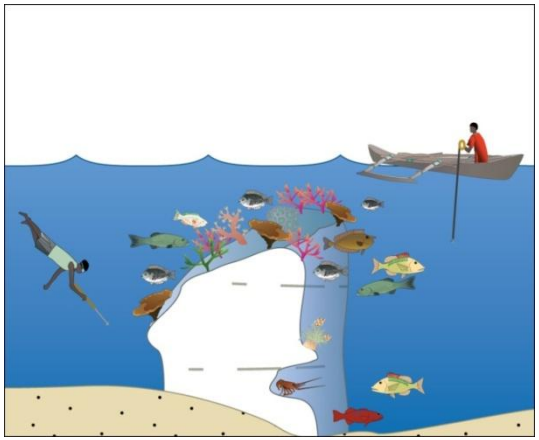
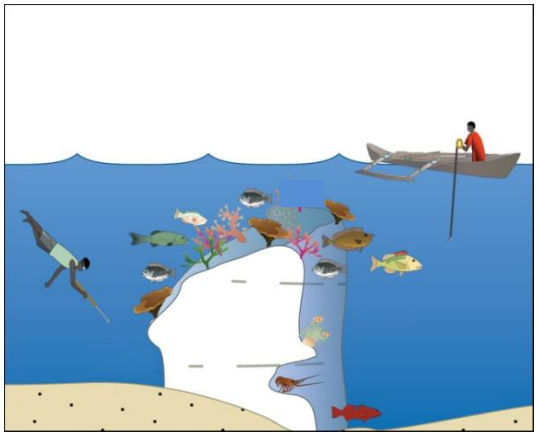
Projections for coastal fisheries under climate change

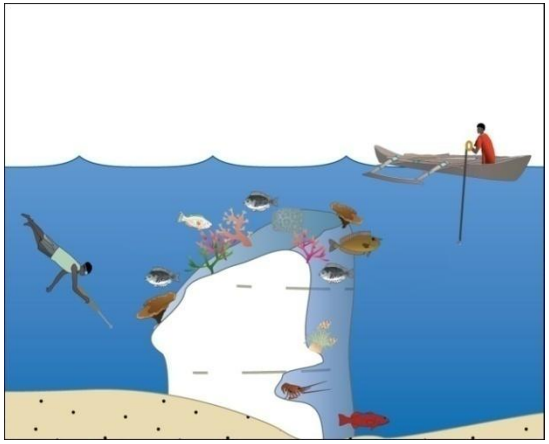
Today



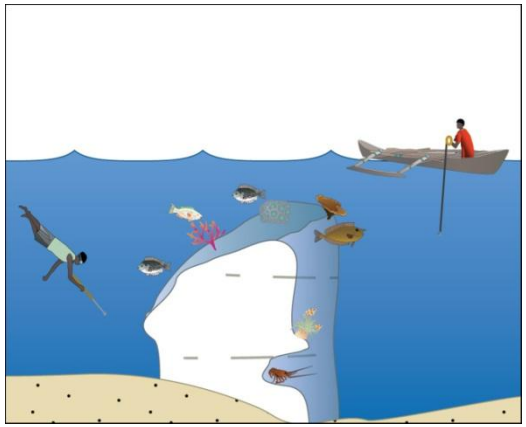
2035 A2 (-2 to -5%)



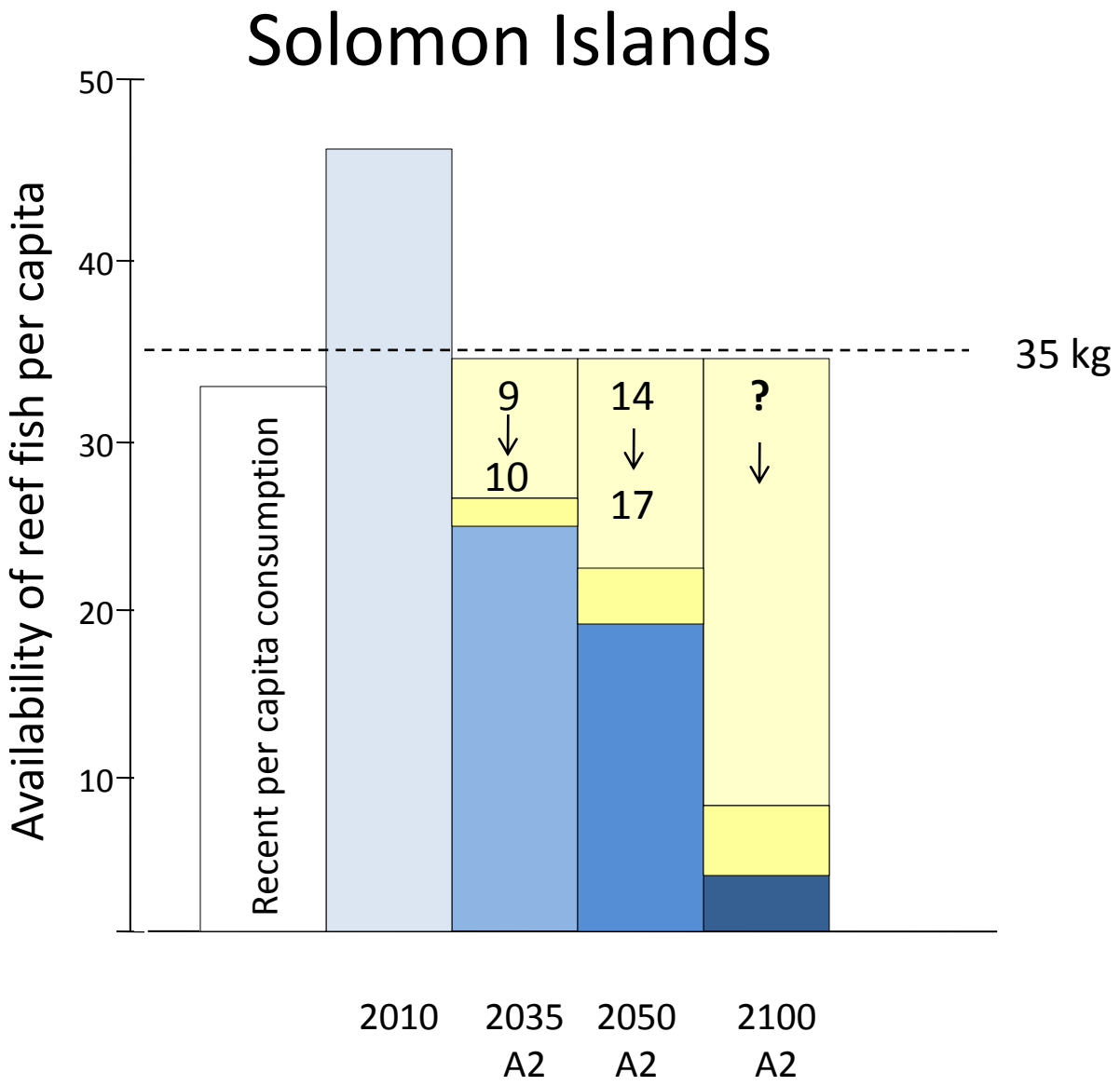
2050 A2 (-20%)



2100 A2 (-20 to -50%)



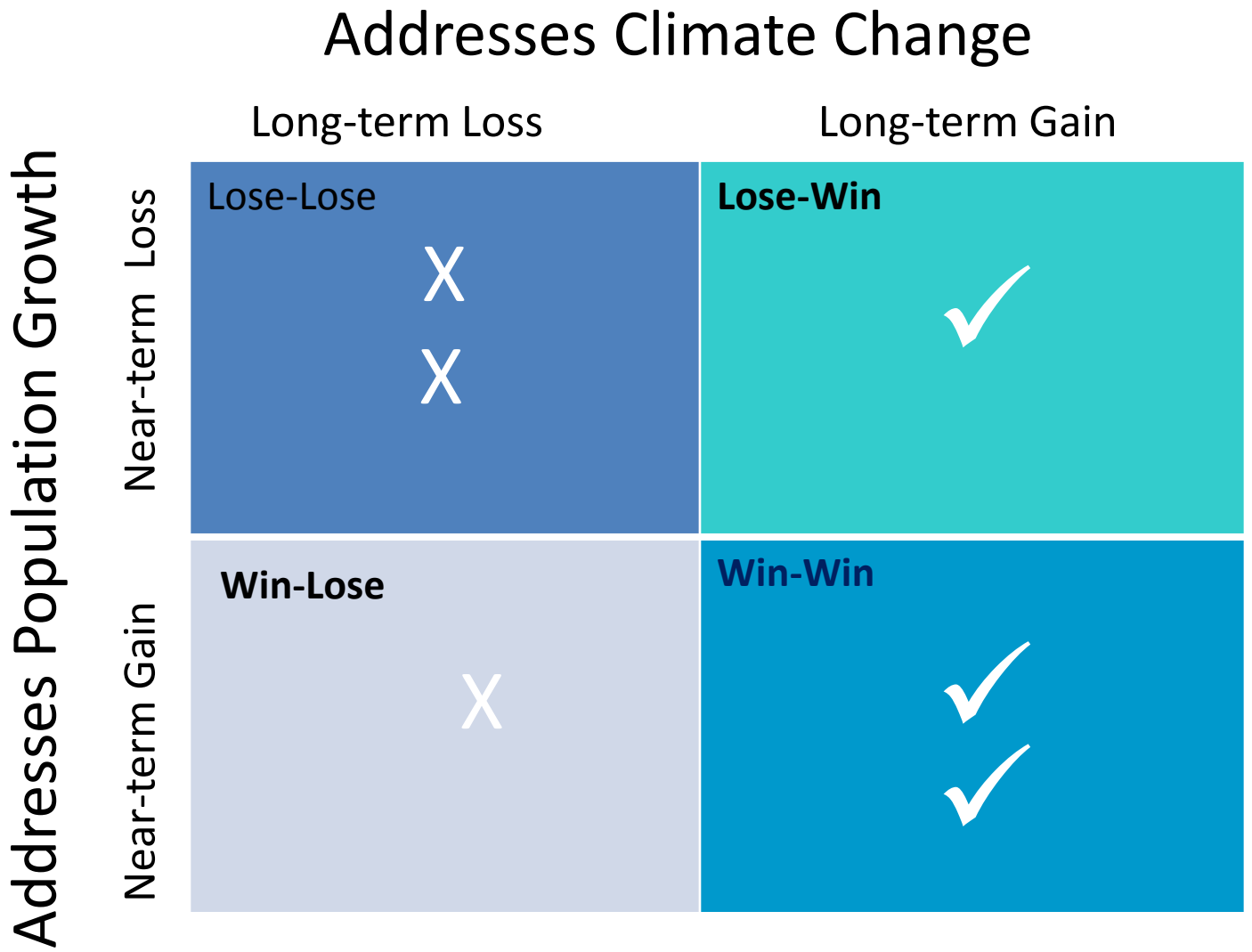
Added effects of climate change



Year	Population
2010	549,000
2035	969,900
2050	1,245,800

4. How should the Pacific Community adapt?

Adaptation decision framework

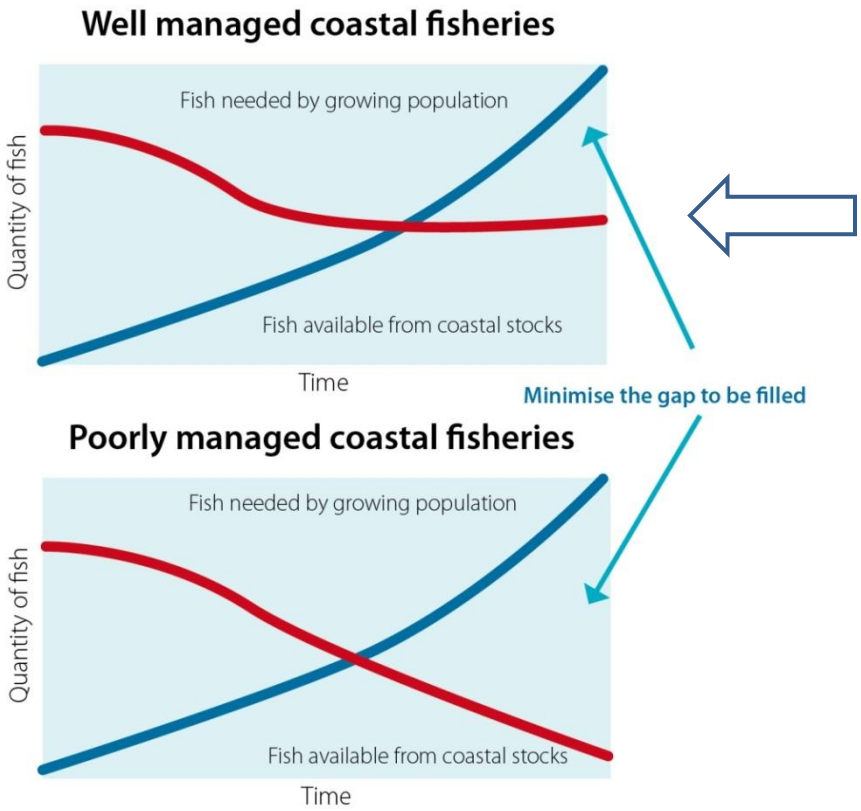


After Grafton (2010)

Adaptations

L-L	L-W
W-L	W-W

Restore and sustain coastal and freshwater fisheries

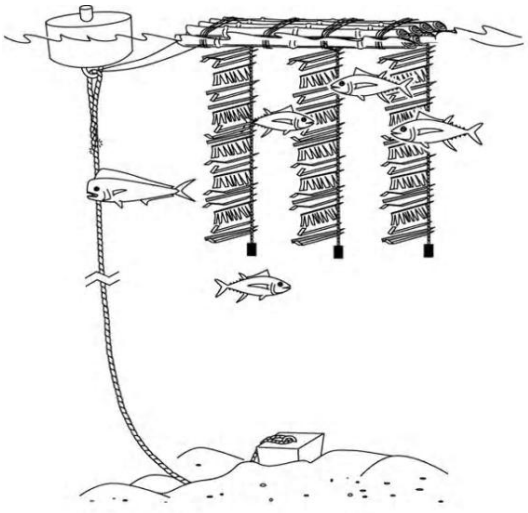


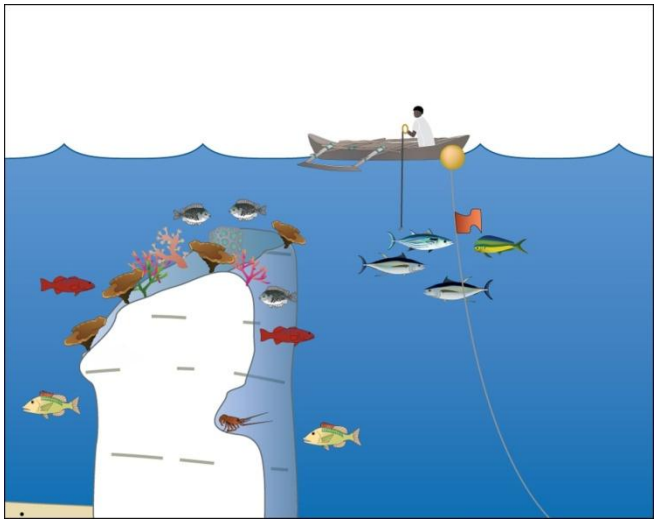
- **FAO Code of Conduct for Responsible Fisheries**
- **Ecosystem Approach Fisheries Management**

Adaptations

L-L	L-W
W-L	W-W

Increase access to tuna for subsistence fishers with low-cost, inshore Fish Aggregating Devices (FADs)





Adaptations

L-L	L-W
W-L	W-W

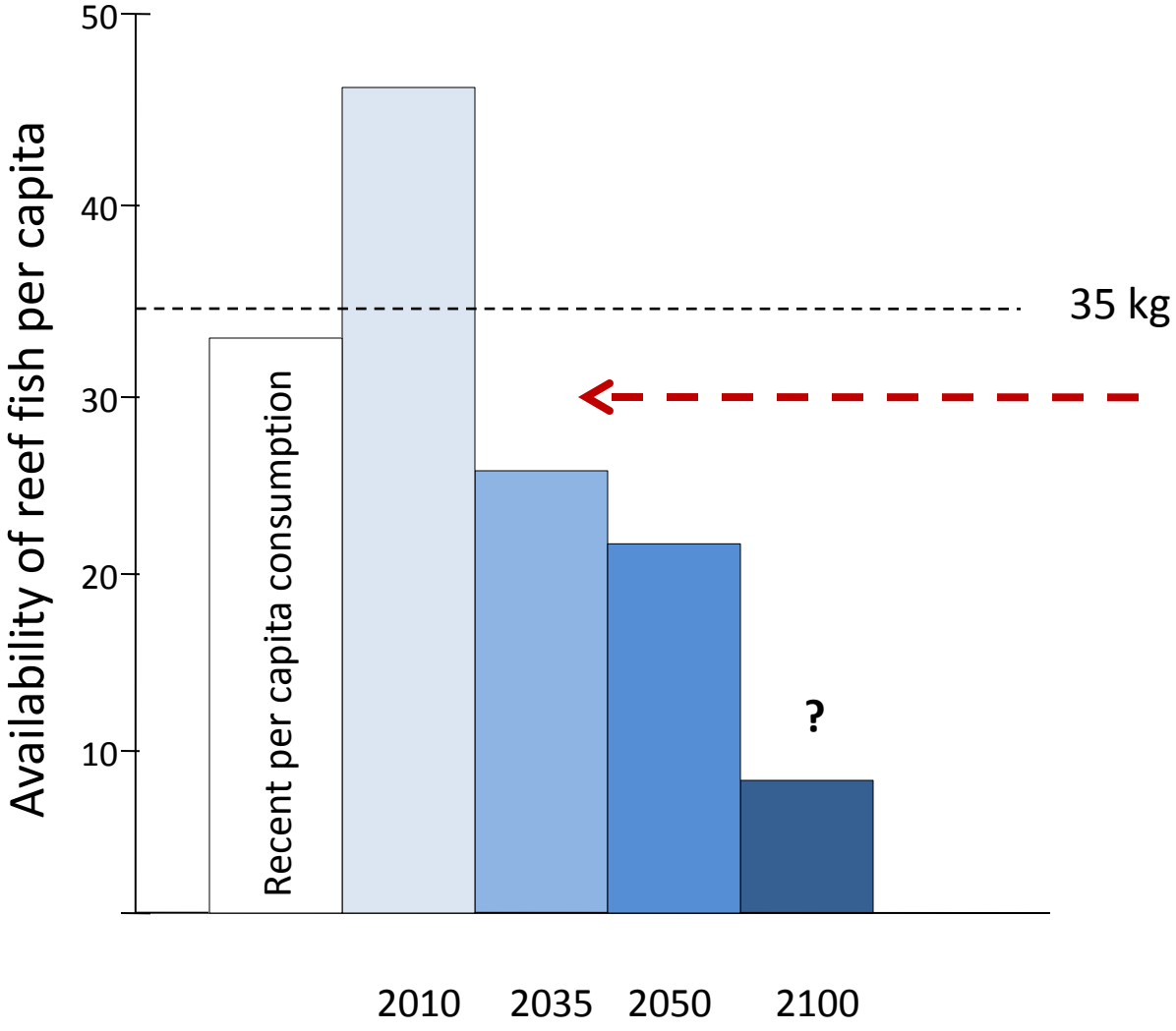
Store and distribute tuna and by-catch from industrial fleets to urban areas

Adaptations

L-L	L-W
W-L	W-W

Develop pond aquaculture

Tuna – the main win-win adaptation



Only resource capable of filling most of the rapidly emerging gap

1,727,000 mt

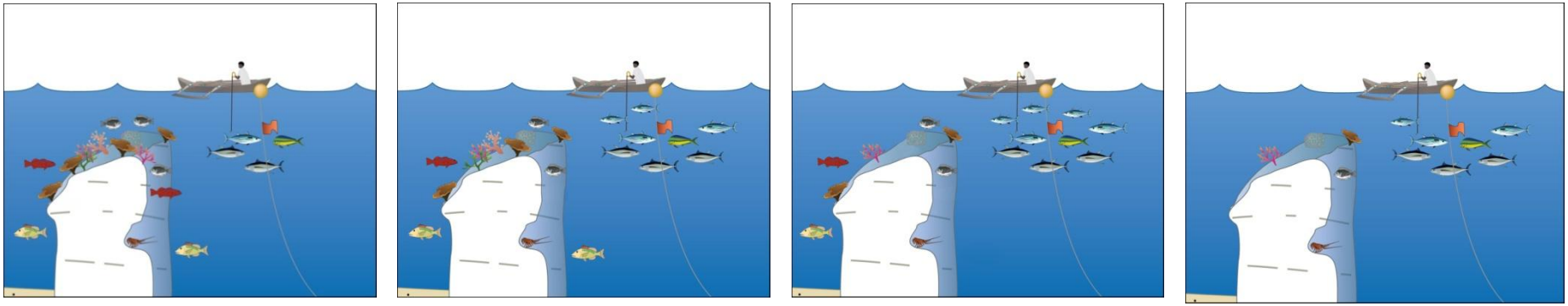
432,000 mt

Pond aquaculture expected to provide only 2 kg per person per year by 2035

Tuna – the main win-win adaptation

- Abundances projected to increase under climate change

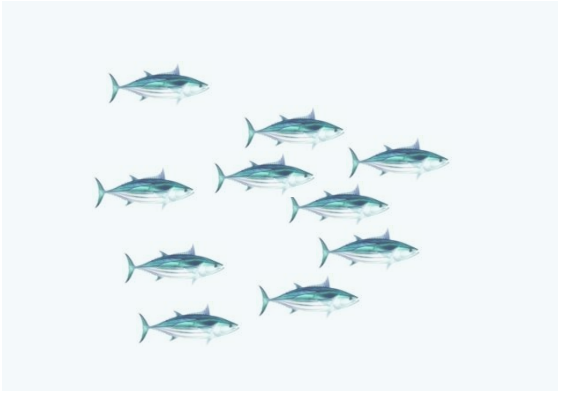
Today | 2035 A2 (+37%) | 2050 A2 (+43%) | 2100 A2 (+27%)



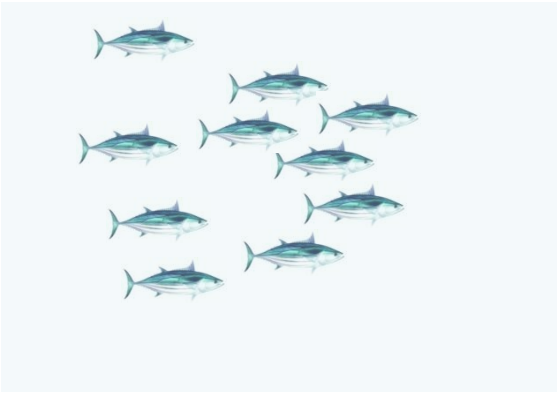
Based on output of SEAPODYM modelling for skipjack tuna by P. Lehodey et al., relative to 1980-2000, in the eastern Pacific area 15°N to 15°S and 170°E to 150°W

Projections for tuna (Solomon Islands)

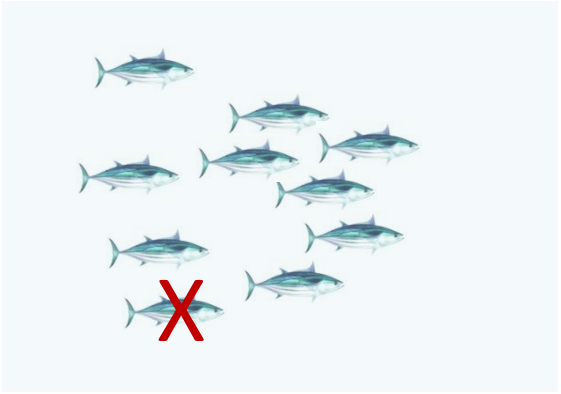
NOW



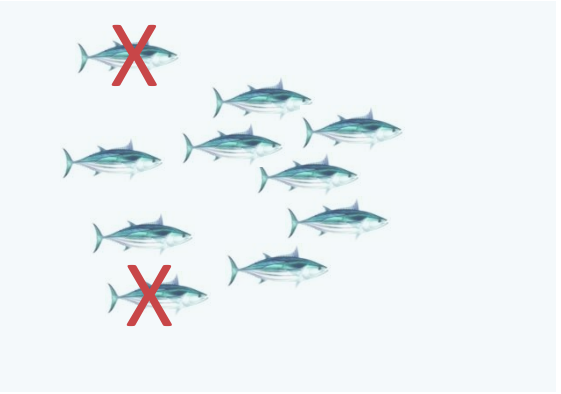
2035 A2 (+3.2 %)



2050 A2 (-5.5%)



2100 A2 (-15.4 %)



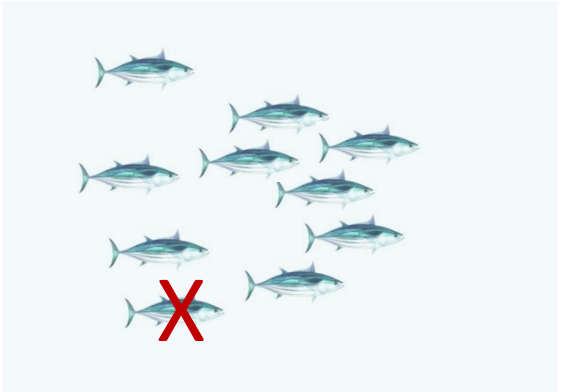
Projections for tuna (Solomon Islands)

NOW

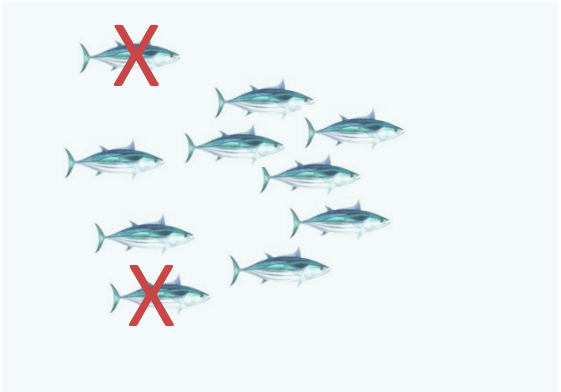
2035 A2 (+3.2 %)

Governments of PNG and Solomon Islands will need to allocate a greater proportion of tuna resources for food security

2050 A2 (-5.5%)



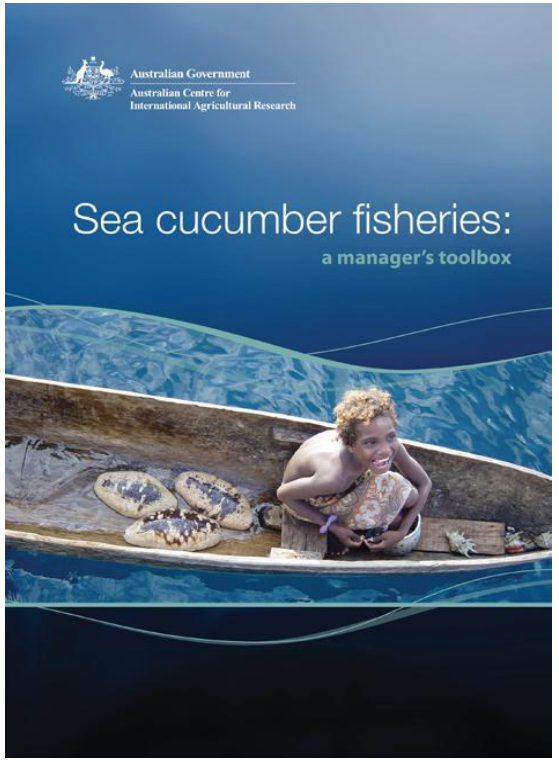
2100 A2 (-15.4 %)



Other adaptations

L-L	L-W
W-L	W-W

Moratoriums to rebuild sea cucumber fisheries

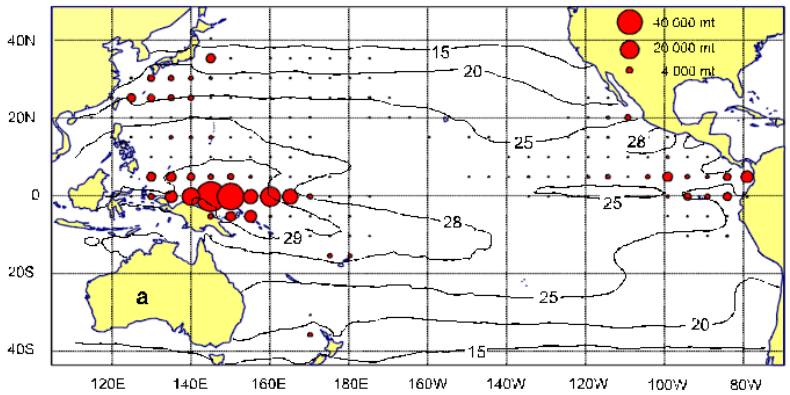


Other adaptations

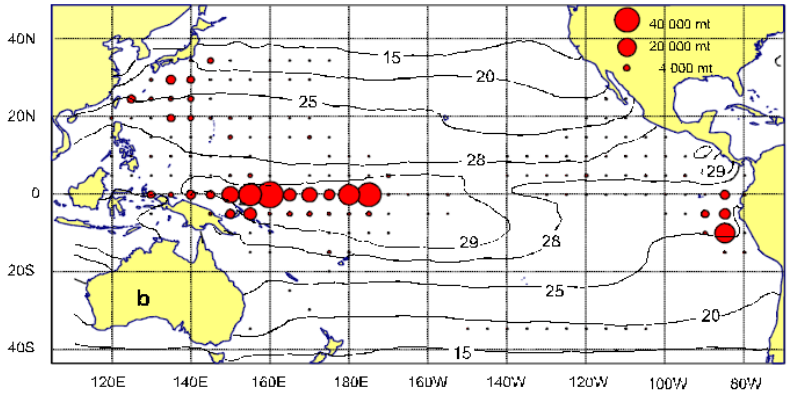
L-L	L-W
W-L	W-W

‘Vessel Day Scheme’ to manage effort of industrial tuna fleets

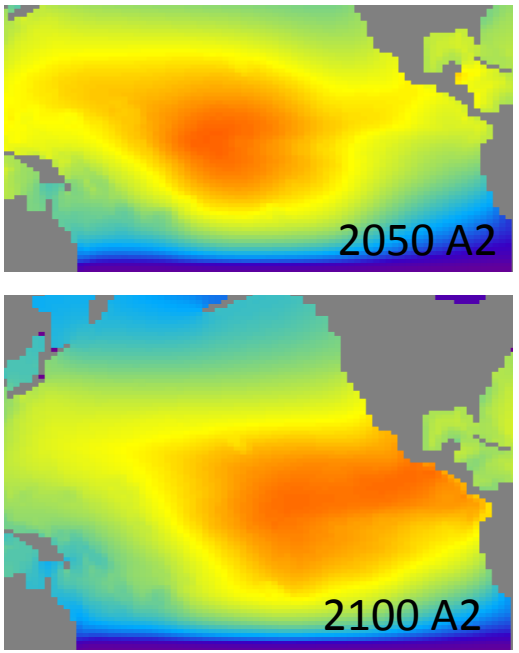
La Niña



El Niño



Skipjack tuna



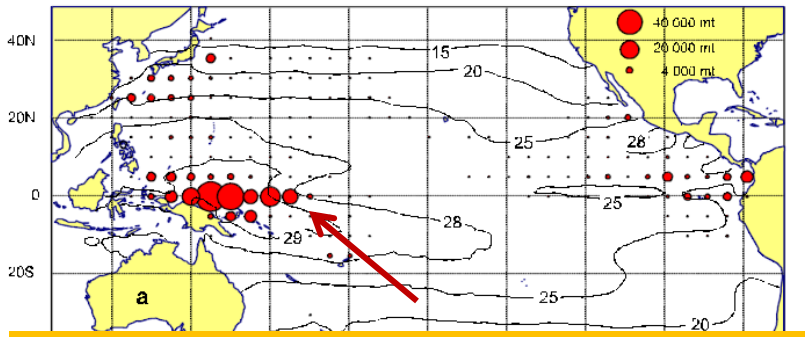
Source: P. Lehodey

Other adaptations

L-L	L-W
W-L	W-W

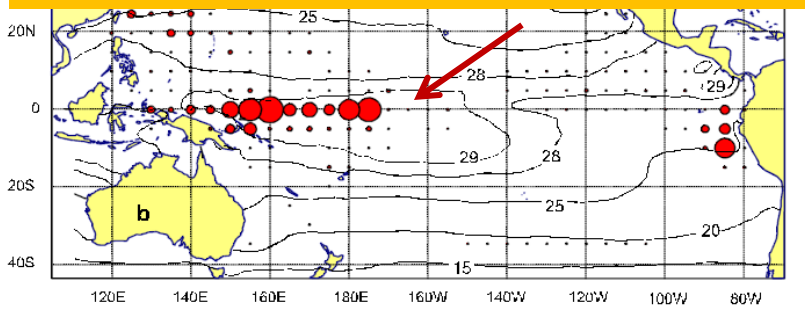
‘Vessel Day Scheme’ to manage effort of industrial tuna fleets

La Niña

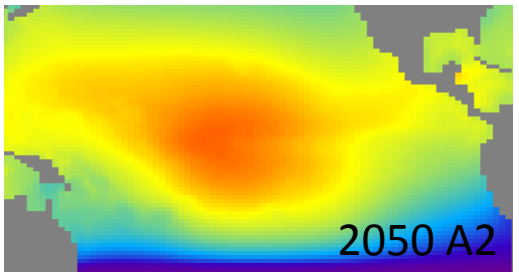


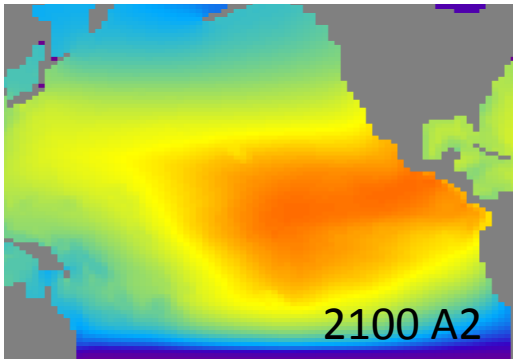
Vessel owners fishing in PNA waters purchase and trade fishing days depending on the location of the tuna

El Niño



Skipjack tuna





Source: P. Lehodey

Summary

- Population growth is a stronger driver than climate change for food security
- Lose-Win adaptations needed to restore and sustain production potential of coastal fisheries
- Win-Win adaptations are needed to respond to both drivers (by diversifying access to fish for food security)

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