Addressing the effects of climate change on fisheries

Johann Bell

Outline

- Global evidence
- Case study from the Pacific Islands
  - Importance of fisheries to the region
  - Plans to optimise socio-economic benefits of fisheries
  - Effects of climate change on plans to optimise fisheries benefits
  - Implications for economic development and food security
  - Investments to fill gaps in knowledge
  - Adaptations & policies to minimise risks and maximise opportunities

Global evidence for effects on fisheries

nature
International journal of science

Letter

Signature of ocean warming in global fisheries catch

William W. L. Cheung, Reg Watson & Daniel Pauly

Nature **497**, 365–368 (16 May 2013)
doi:10.1038/nature12156

REVIEW

CLIMATE CHANGE

Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being

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sponse. Marine, freshwater, and terrestrial organisms are altering distributions to stay within their preferred environmental conditions (*5–8*), and species are likely changing distributions more rapidly than they have in the past (*9*). Unlike the introduction of non-native species, which tends to be idiosyncratic and usually depends on human-mediated transport, climate-driven redistribution is ubiquitous, follows repeated patterns, and is poised to influence a greater proportion of Earth's biota. This redistribution of the planet's living organisms is a substantial challenge for human society.

Despite agreements to curb greenhouse gas emissions, the climate will continue to change for at least the next several hundred years, given the inertia of the oceanic and atmospheric circulation systems (*10*), and species will continue to respond, often with unpredictable consequences. Since 1880, there has been an average warming of 0.85°C globally (*10*), resulting in well-documented shifts in species distributions with far-reaching implications for human societies, yet governments have agreed to accept more than double this amount of warming in the future (e.g., the 2°C target from the Paris Conference of Parties 21). Moreover, current global commitments will only limit warming to 2.7° to 3.7°C, more than three to four times the warming already experienced (*11*). To date, all key international discussions and agreements regarding climate change have focused on the direct socioeconomic implications of emissions reduction and on funding mechanisms; shifting natural ecosystems have not yet been considered in detail.

Here we review the consequences of climate-driven species redistribution for economic development and the provision of ecosystem services, including livelihoods, food security, and culture, as well as for feedbacks on the climate itself (Fig. 1 and table S1). We start by examining the impacts of climate-driven species redistribution on ecosystem health, human well-being, and the climate system, before highlighting the governance challenges these impacts individually and collectively

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nature climate change

LETTERS

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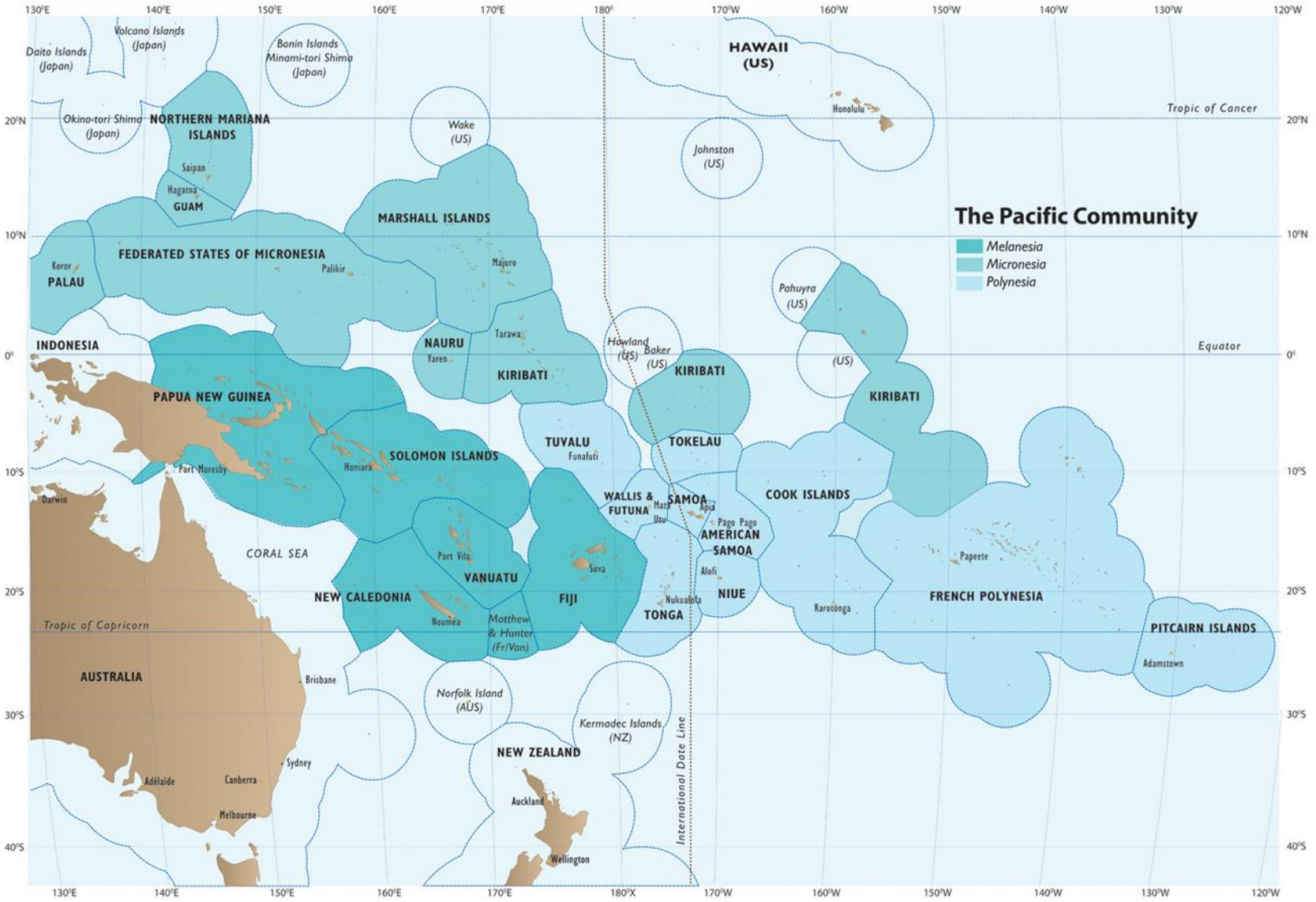
Impacts of climate change on marine ecosystem production in societies dependent on fisheries

M. Barange[1]*, G. Merino[1,2], J. L. Blanchard[3], J. Scholtens[4], J. Harle[5], E. H. Allison[6], J. I. Allen[1], J. Holt[5] and S. Jennings[7,8]

Growing human populations and changing dietary preferences are increasing global demands for fish[1], adding pressure to concerns over fisheries sustainability[2]. Here we develop and link models of physical, biological and human responses to

production has several uncertainties, in addition to their structural and natural variability uncertainties[9]. First, the resolution of GCMs is too coarse (typically 1°–2°) to capture the processes that dominate the dynamics of the world's coastal and shelf regions, such as

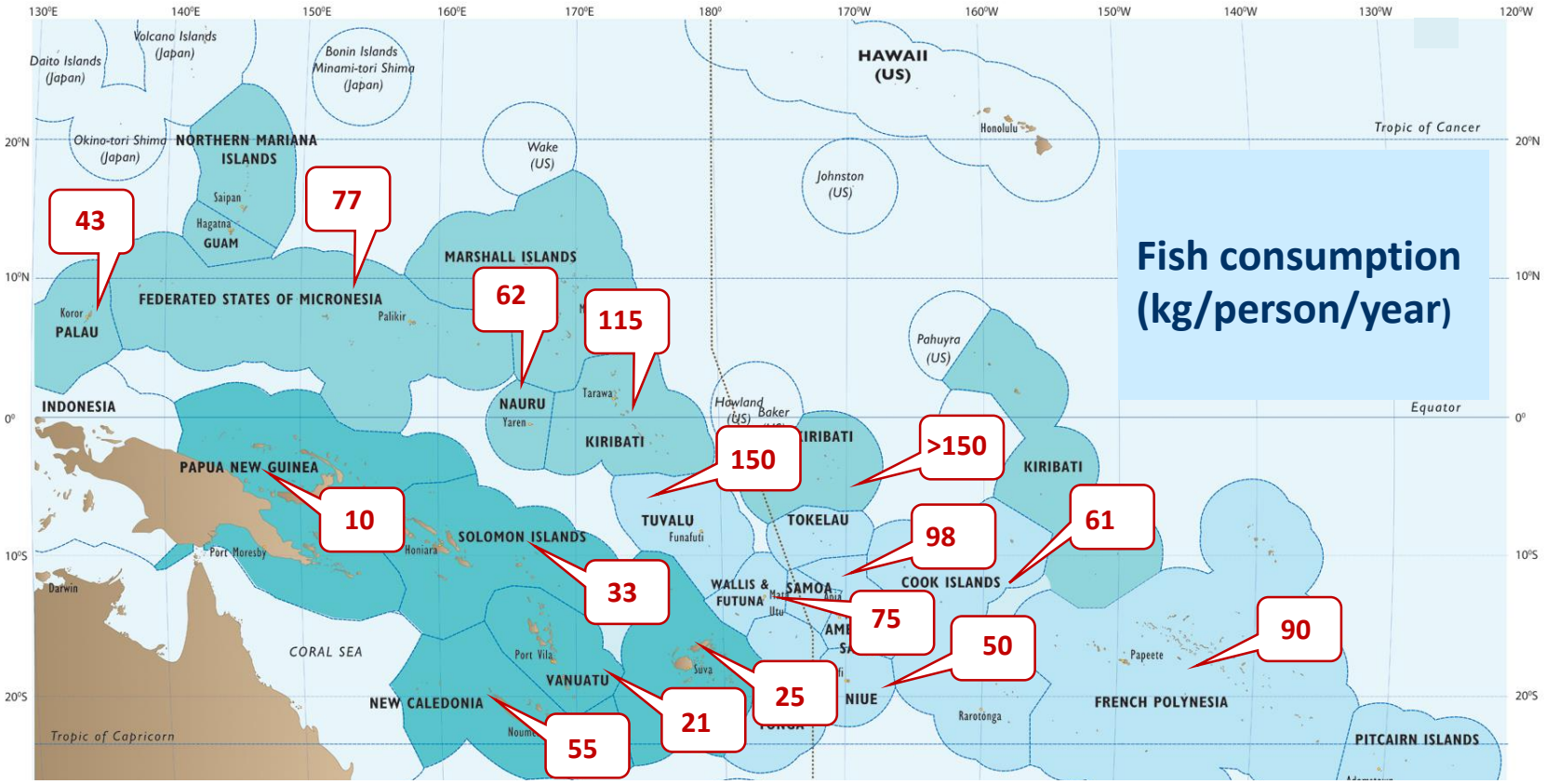
Pacific Island region



- >40 shared maritime boundaries
- >10 still to be negotiated
- Transboundary tuna stocks
- Extensive, vulnerable coral reefs

Benefits of fish to Pacific Islands

- Food security



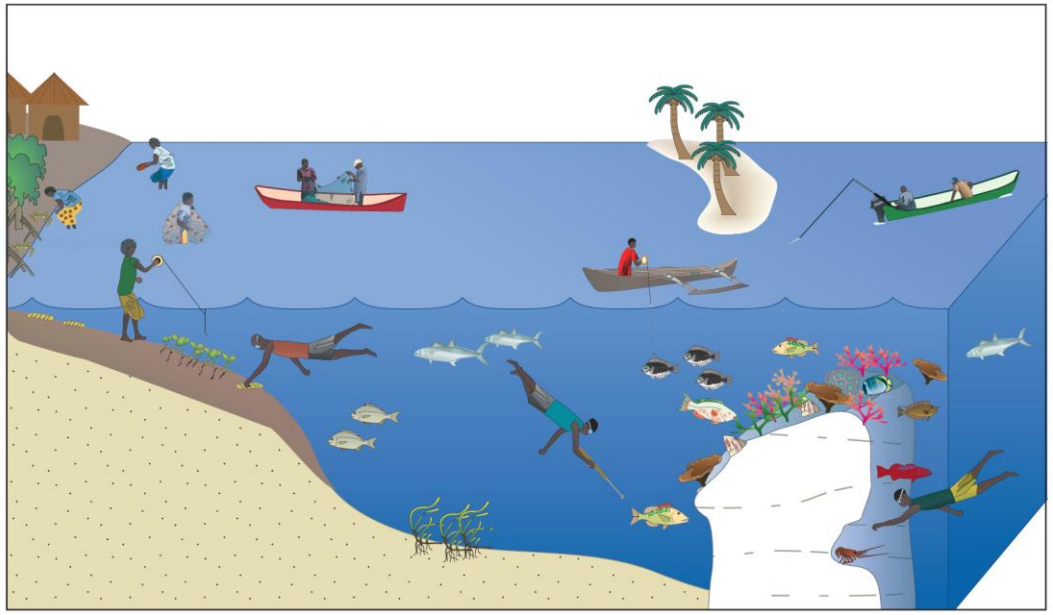
Source: Bell et al. (2009), Gillett (2009)

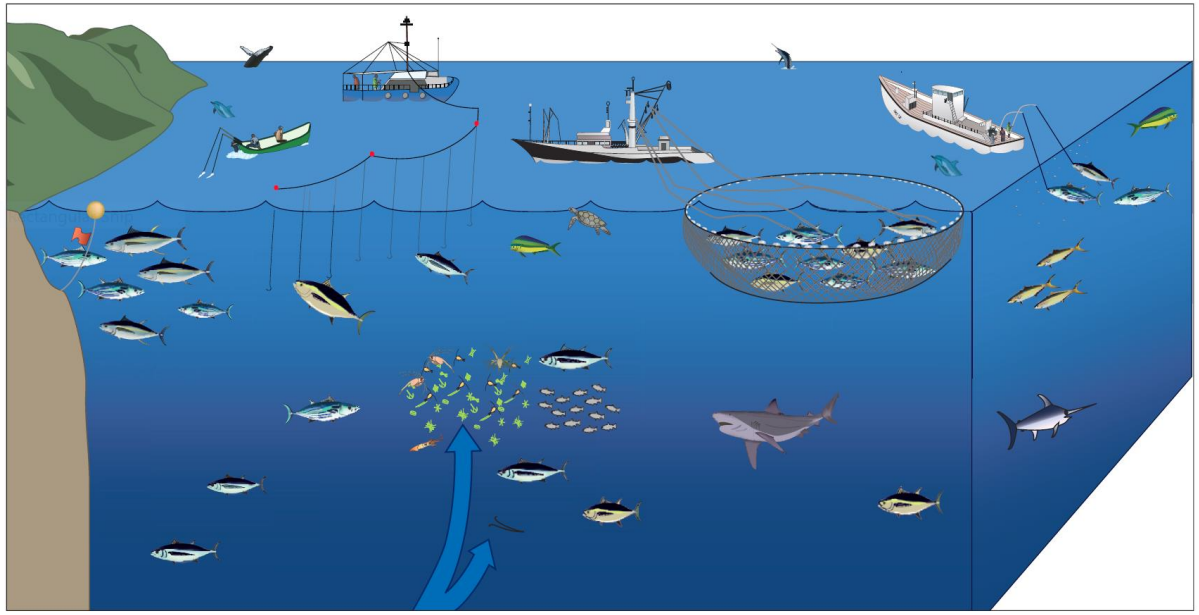
Benefits of fisheries to Pacific Islands

- Jobs and other opportunities to earn income

50% of surveyed coastal households in 17 Pacific Island countries earned their 1st or 2nd income from catching/selling fish

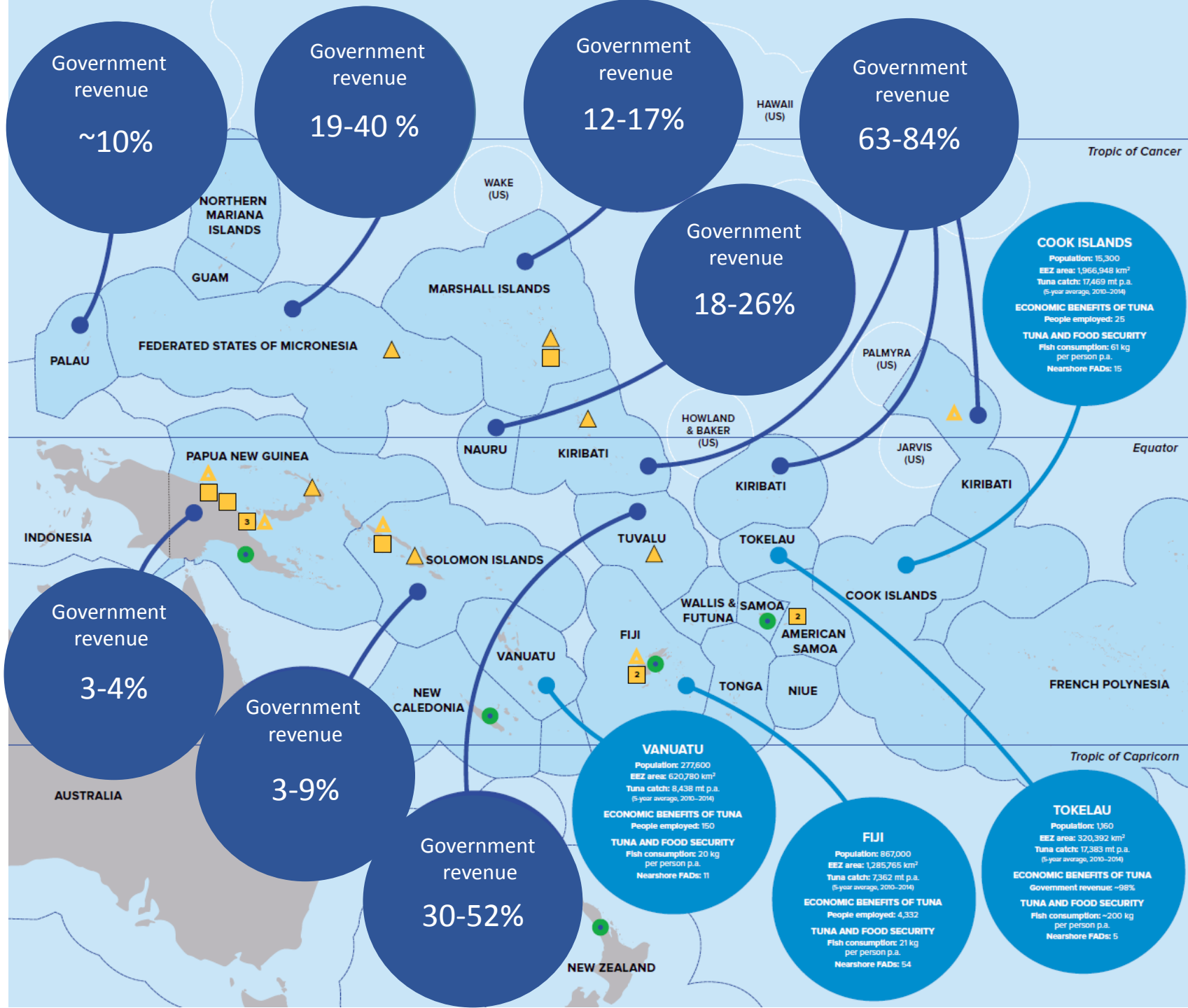
23,000 jobs have been created in processing tuna, working on tuna vessels or helping to manage tropical tuna fisheries





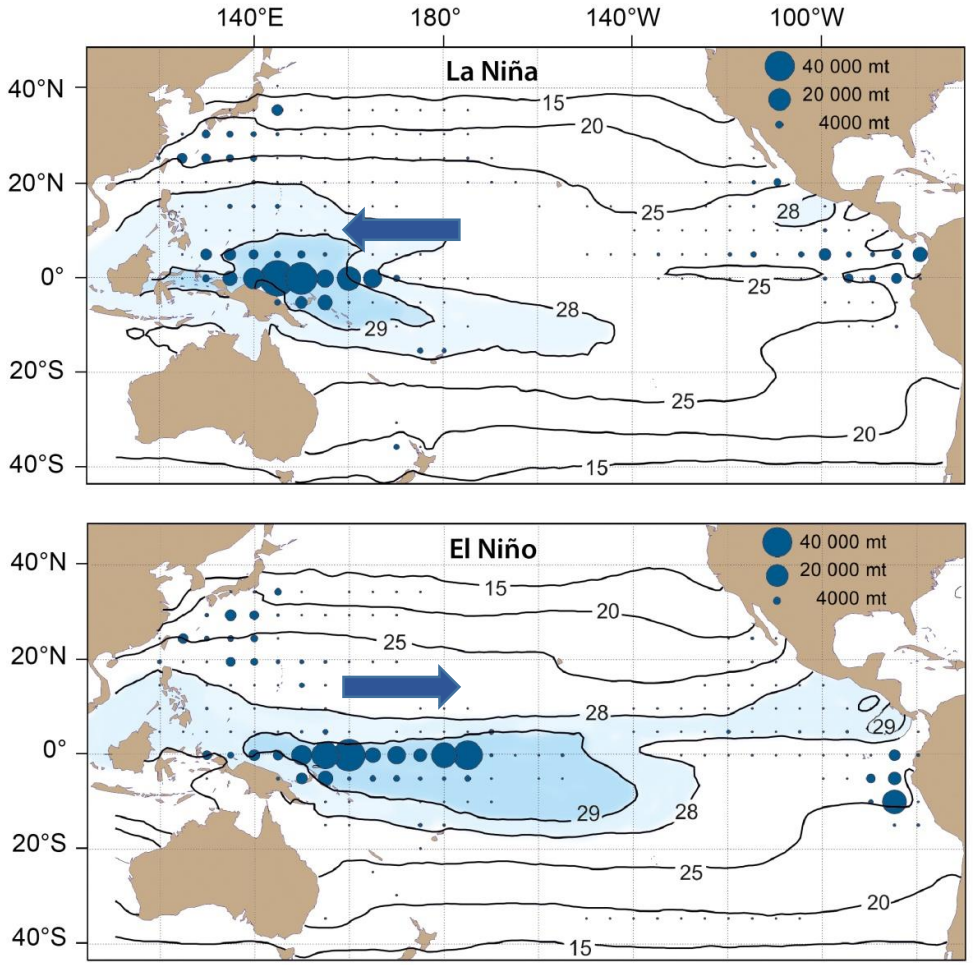
Economic development

Parties to the Nauru Agreement



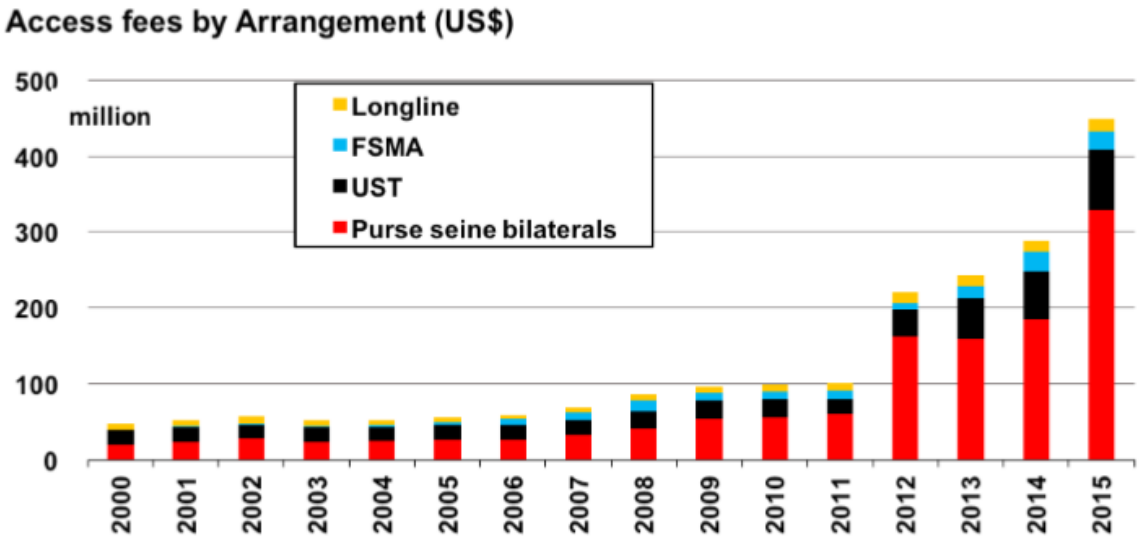
Basis of economic development

- Vessel day scheme operated by PNA



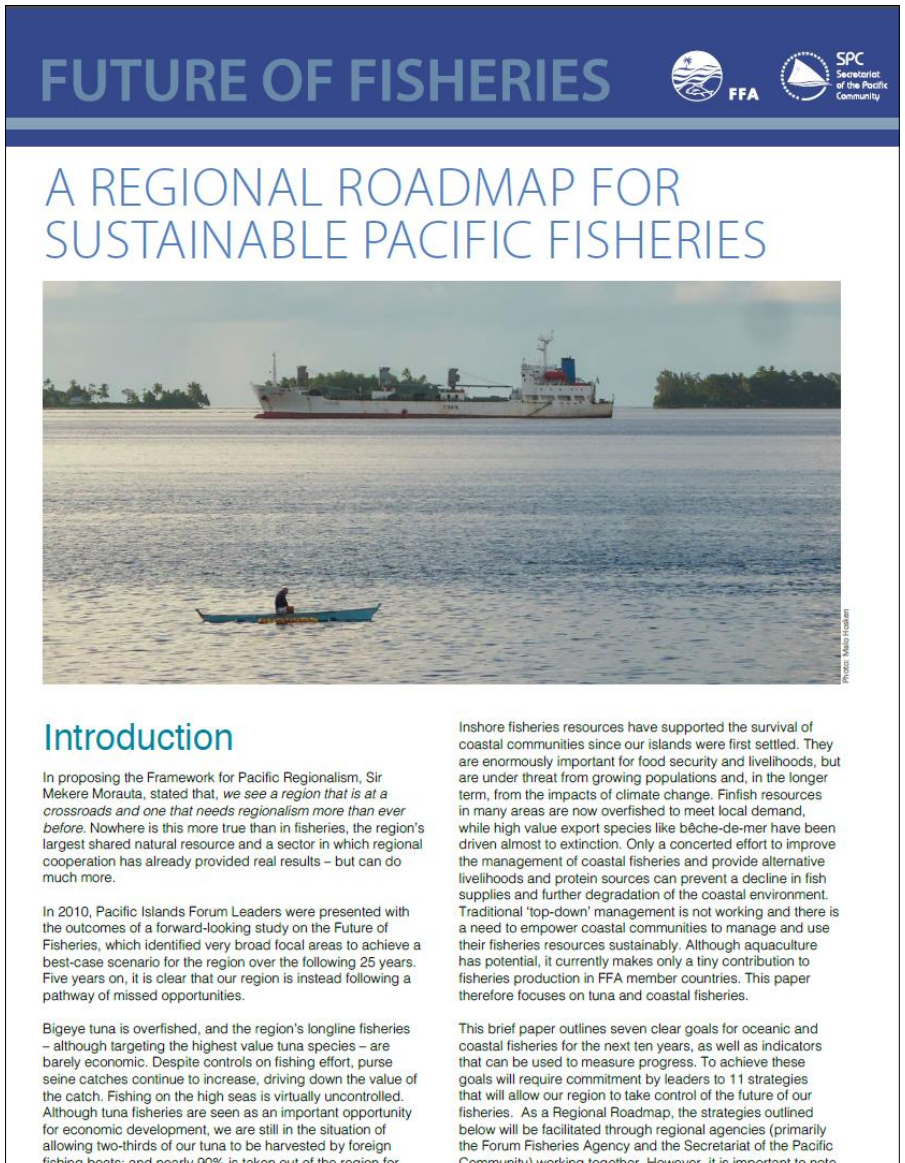
- **Based on purse-seine fishing for skipjack tuna**
- **Supplies 30% of world's tuna**

Skipjack tuna



Source: Lehodey et al. (1997), FFA (2009)

Plans to optimise socio-economic benefits



FUTURE OF FISHERIES

FFA

SPC Secretariat of the Pacific Community

A REGIONAL ROADMAP FOR SUSTAINABLE PACIFIC FISHERIES

Introduction

In proposing the Framework for Pacific Regionalism, Sir Mekere Morauta, stated that, *we see a region that is at a crossroads and one that needs regionalism more than ever before.* Nowhere is this more true than in fisheries, the region's largest shared natural resource and a sector in which regional cooperation has already provided real results – but can do much more.

In 2010, Pacific Islands Forum Leaders were presented with the outcomes of a forward-looking study on the Future of Fisheries, which identified very broad focal areas to achieve a best-case scenario for the region over the following 25 years. Five years on, it is clear that our region is instead following a pathway of missed opportunities.

Bigeye tuna is overfished, and the region's longline fisheries – although targeting the highest value tuna species – are barely economic. Despite controls on fishing effort, purse seine catches continue to increase, driving down the value of the catch. Fishing on the high seas is virtually uncontrolled. Although tuna fisheries are seen as an important opportunity for economic development, we are still in the situation of allowing two-thirds of our tuna to be harvested by foreign

Inshore fisheries resources have supported the survival of coastal communities since our islands were first settled. They are enormously important for food security and livelihoods, but are under threat from growing populations and, in the longer term, from the impacts of climate change. Finfish resources in many areas are now overfished to meet local demand, while high value export species like bêche-de-mer have been driven almost to extinction. Only a concerted effort to improve the management of coastal fisheries and provide alternative livelihoods and protein sources can prevent a decline in fish supplies and further degradation of the coastal environment. Traditional 'top-down' management is not working and there is a need to empower coastal communities to manage and use their fisheries resources sustainably. Although aquaculture has potential, it currently makes only a tiny contribution to fisheries production in FFA member countries. This paper therefore focuses on tuna and coastal fisheries.

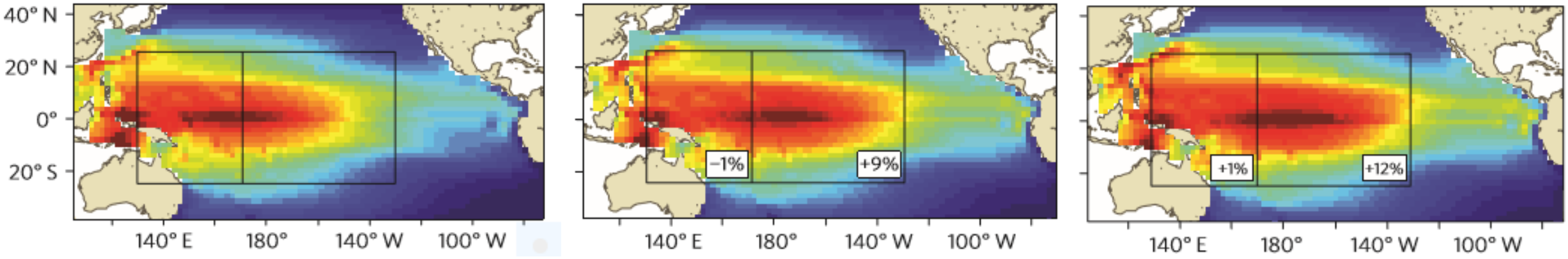
This brief paper outlines seven clear goals for oceanic and coastal fisheries for the next ten years, as well as indicators that can be used to measure progress. To achieve these goals will require commitment by leaders to 11 strategies that will allow our region to take control of the future of our fisheries. As a Regional Roadmap, the strategies outlined below will be facilitated through regional agencies (primarily the Forum Fisheries Agency and the Secretariat of the Pacific

- Goals by 2024
  - Double the value of the tuna catch
  - Create another 18,000 jobs based on tuna
  - Allocate an additional 40,000 Mt of tuna per year for food security

How could climate change affect these plans?

Effects of climate change on skipjack tuna

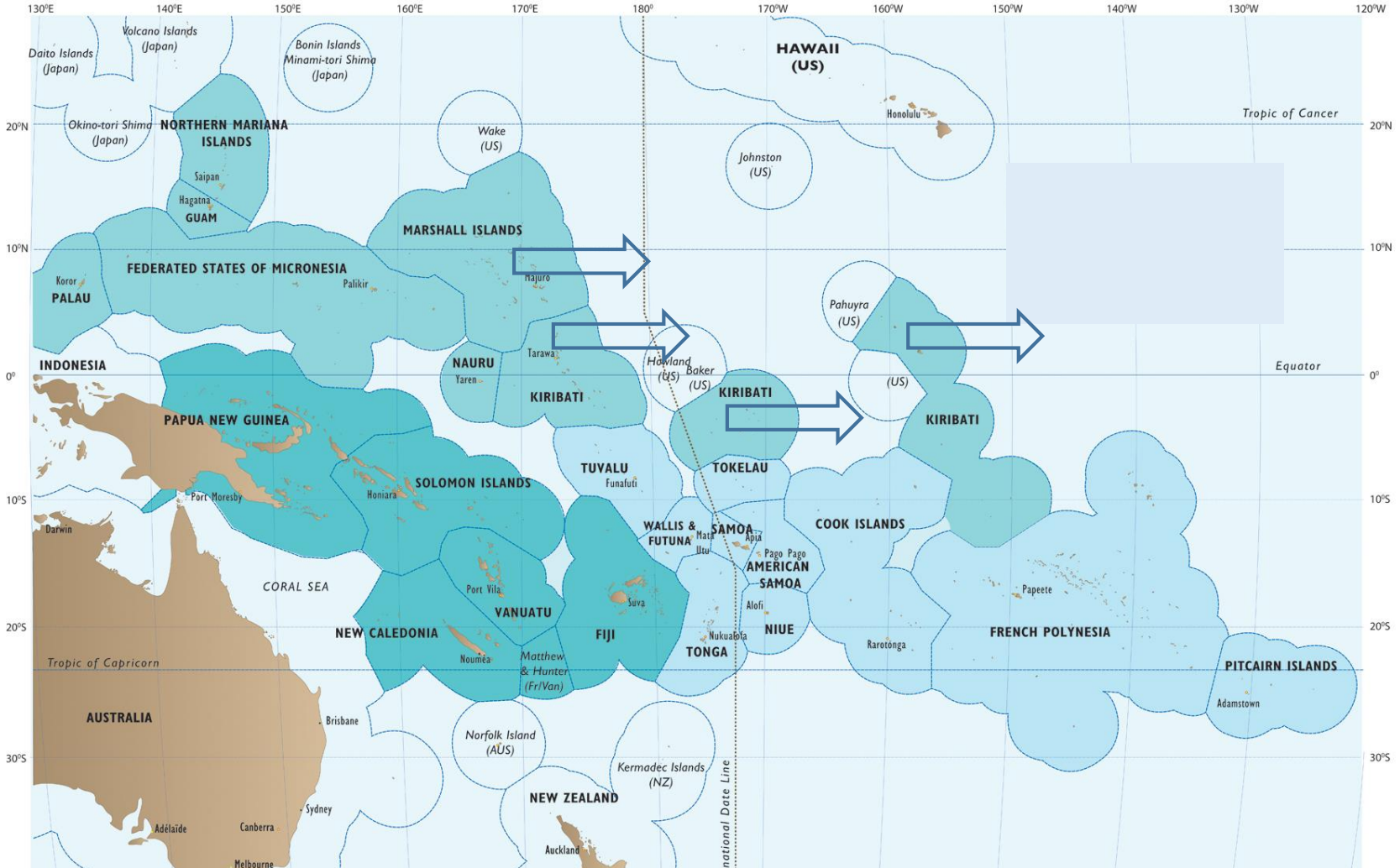
2005 **2035** **2050**



Source: Lehodey et al. (2013)

Implications for economic development

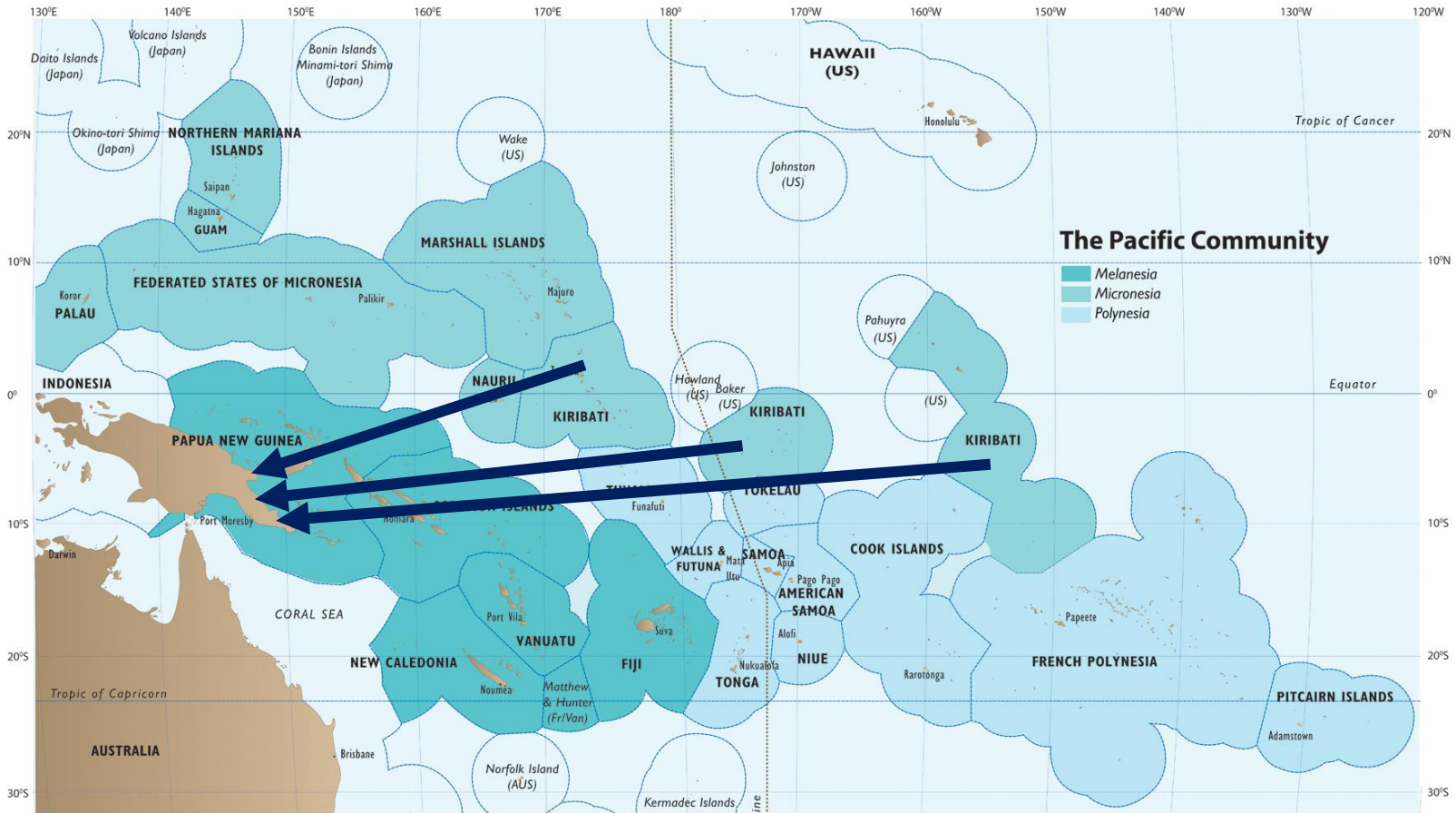
- Effects on vessel day scheme



- A greater proportion of tuna resources will occur on the high seas
- Demand for fishing days within EEZs could decline, with possible loss of licence revenue

Implications for economic development

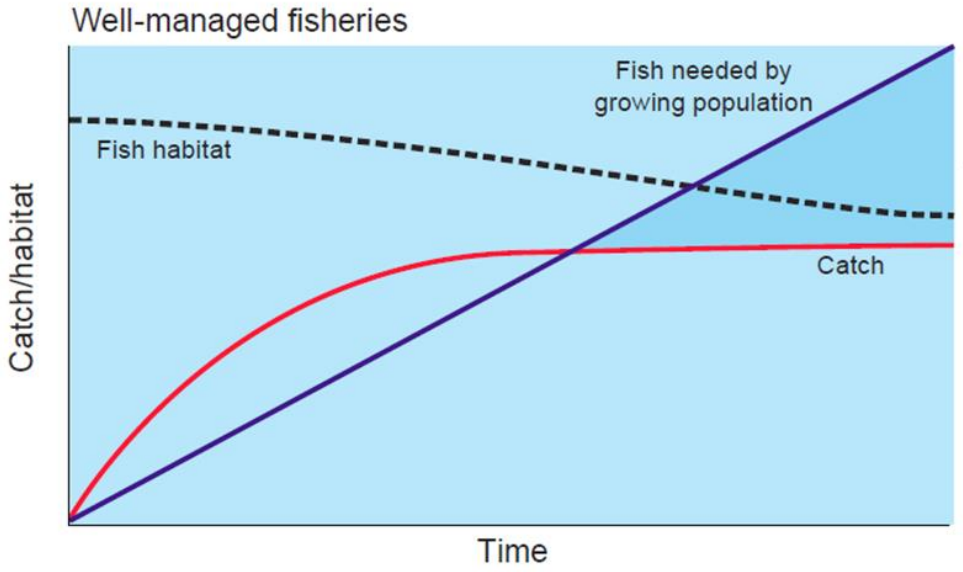
- Need for PNG to maintain Economic Partnership Agreement with EU (with global sourcing provisions) to supply canneries

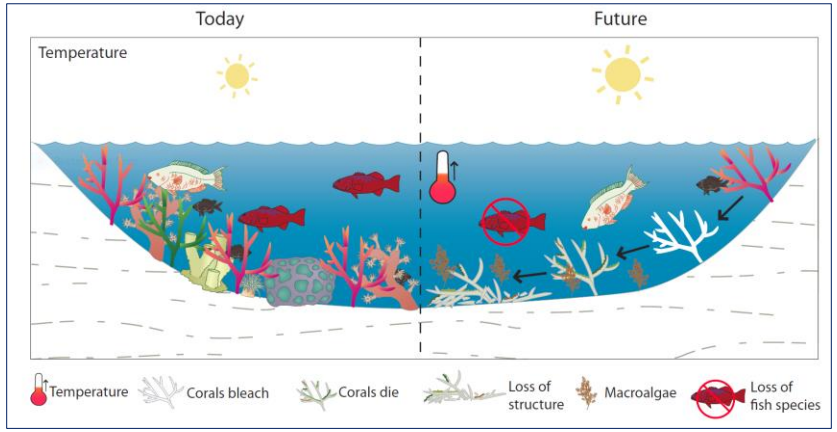


Implications for economic development

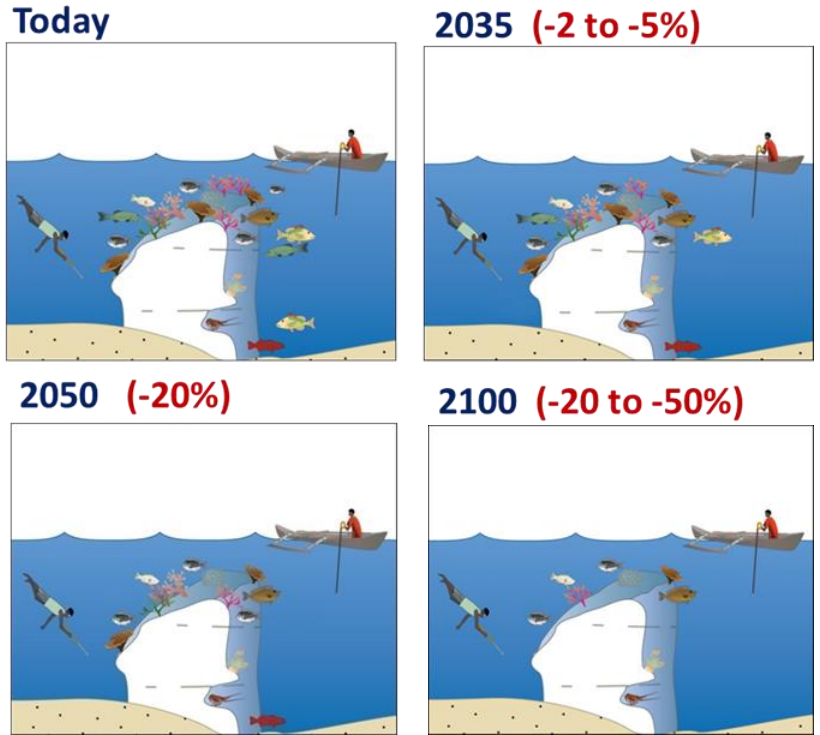
- Countries in east may be able to make more from transshipping operations

Implications for food security





Increased coral bleaching

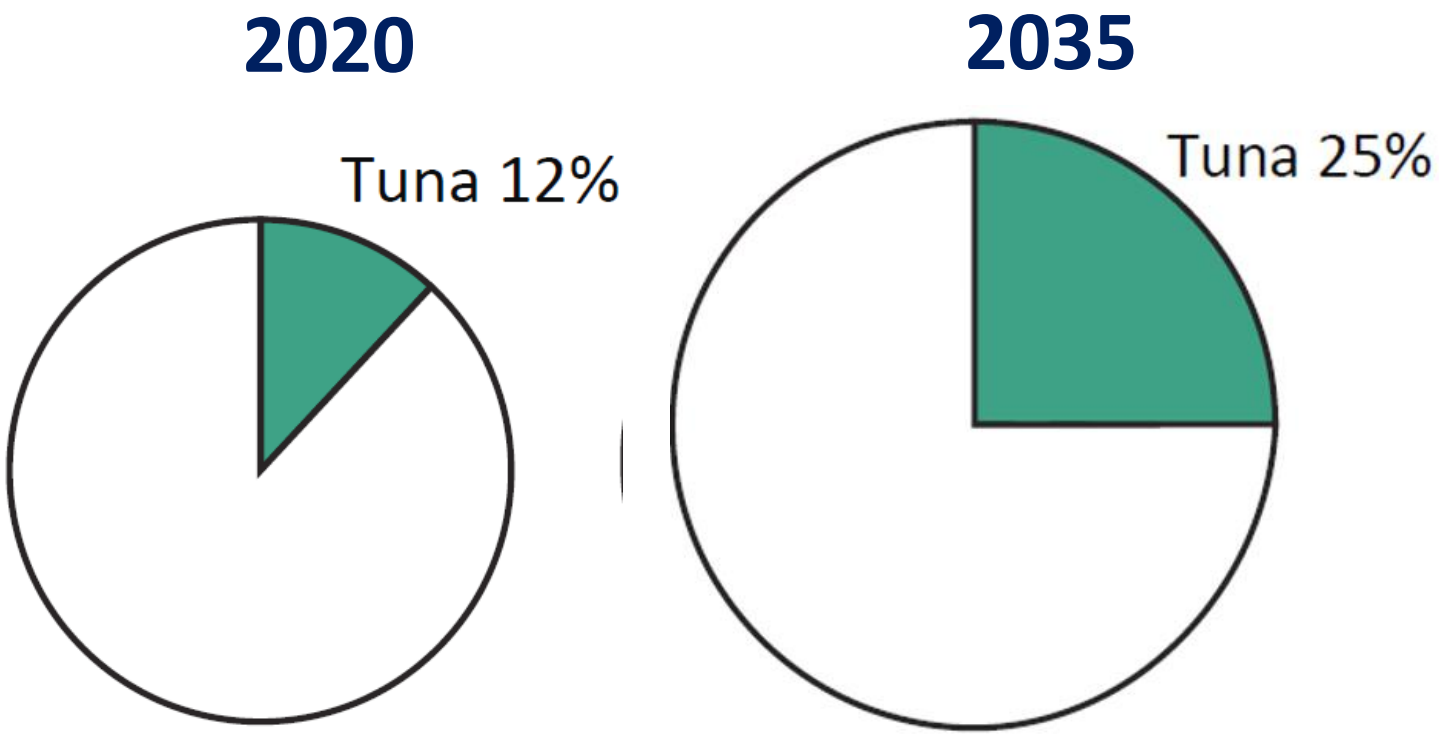


Reduced reef fish production

Source: Bell et al. (2011)

Implications for food security

- Tuna will have to fill the gap

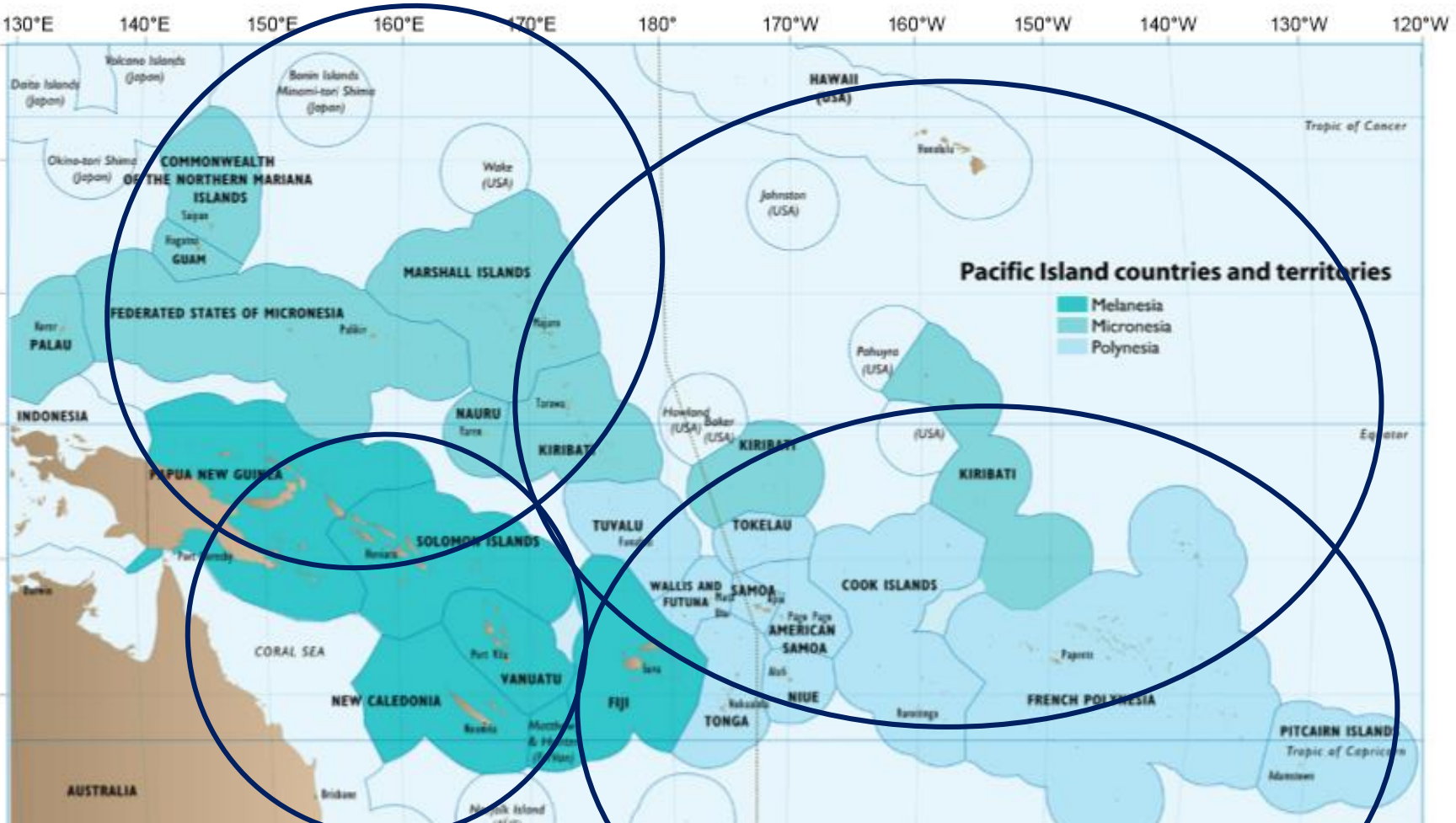


	2020	2035
Total fish needed (Mt):	268,000	345,000
Tuna needed (Mt):	32,000	87,500
% regional tuna catch:	2%	6%
% PNG catch:	3%	10%

Source: Bell et al. (2015)

Investments needed to inform adaptation

- Identification of stock structure



- Improved understanding of resource sharing
- Assessments for each self-replenishing stock
- Altered management arrangements
- Separate climate modelling for each stock
- Evaluation of large MPAs

Possible adaptations

- Adding value to skipjack tuna

+

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Katsuobushi

- Could help maintain licence fees:
  - If VDS days are reduced
  - When more tuna is allocated to domestic food security

Adaptations for food security

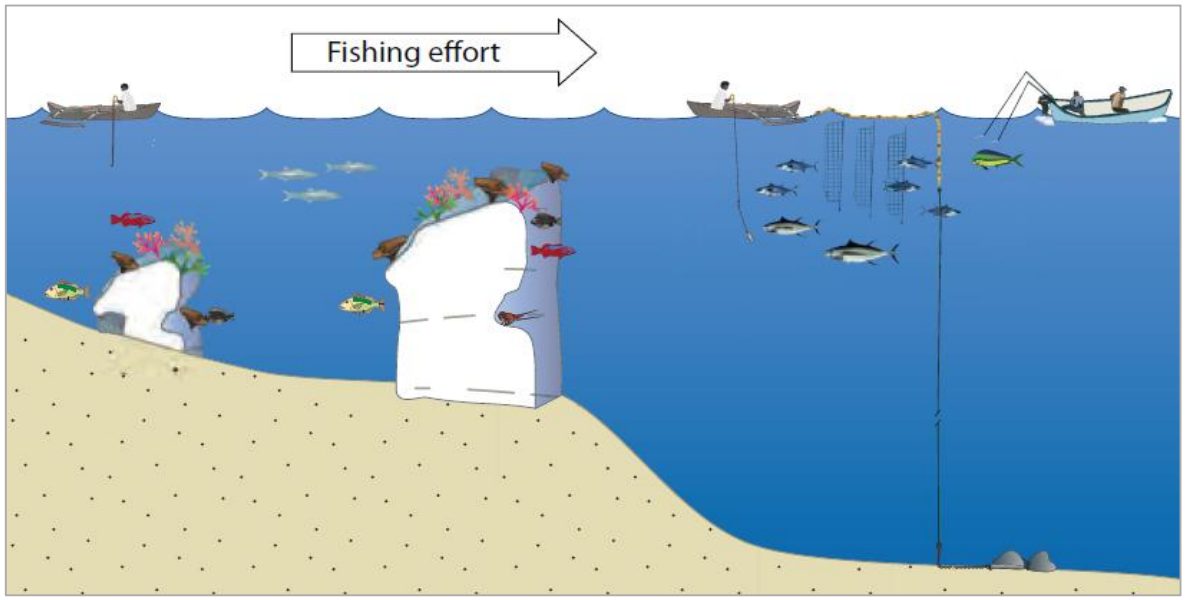
- Urban centres

Distribute small tuna from transshipping operations

Photo credits: SPC and Johann Bell

- Coastal communities

Transfer some fishing effort from coral reefs to tuna



Source: Bell et al. (2011), SPC (2014)

Supporting policies for food security

- **Existing policies**
  - Allocate tuna for national food security
- **Potential policies**
  - Mandate minimum numbers of transhipments to maintain supply of tuna to urban areas
  - Use tuna licence fees to make FADs part of national infrastructure for food security

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Tuna fisheries

Goals and indicators:

1. Sustainability

A sustainable resource is a prerequisite to sustainable development. Within 3 years, there will be agreed Target Reference Points for the four key tuna species. Within 10 years, the status of each species will be clearly moving towards these targets. In particular, the overfishing of bigeye tuna will have been removed and the stock will be rebuilding. Impacts of fishing on by-catch such as sharks, turtles and seabirds will have been significantly reduced. Management measures will not be undermined by Illegal, Unreported and Unregulated fishing (IUU).

2. Value

The region's tuna catch in 2024 will be worth double what it is in 2014. This will be achieved by increasing value rather than volume, by eliminating oversupply and targeting higher value products and markets. In line with increased value and profitability, there will be scope to increase access fees for countries that wish to continue licensing foreign vessels.

3. Employment

18,000 new jobs will be created in the tuna industry within 10 years. While many of these will be in tuna processing in Melanesia, opportunities for nationals of all FFA members will be created for vessel crew, observers and fisheries management staff. Standards to ensure employment is safe and worthwhile will be harmonised.

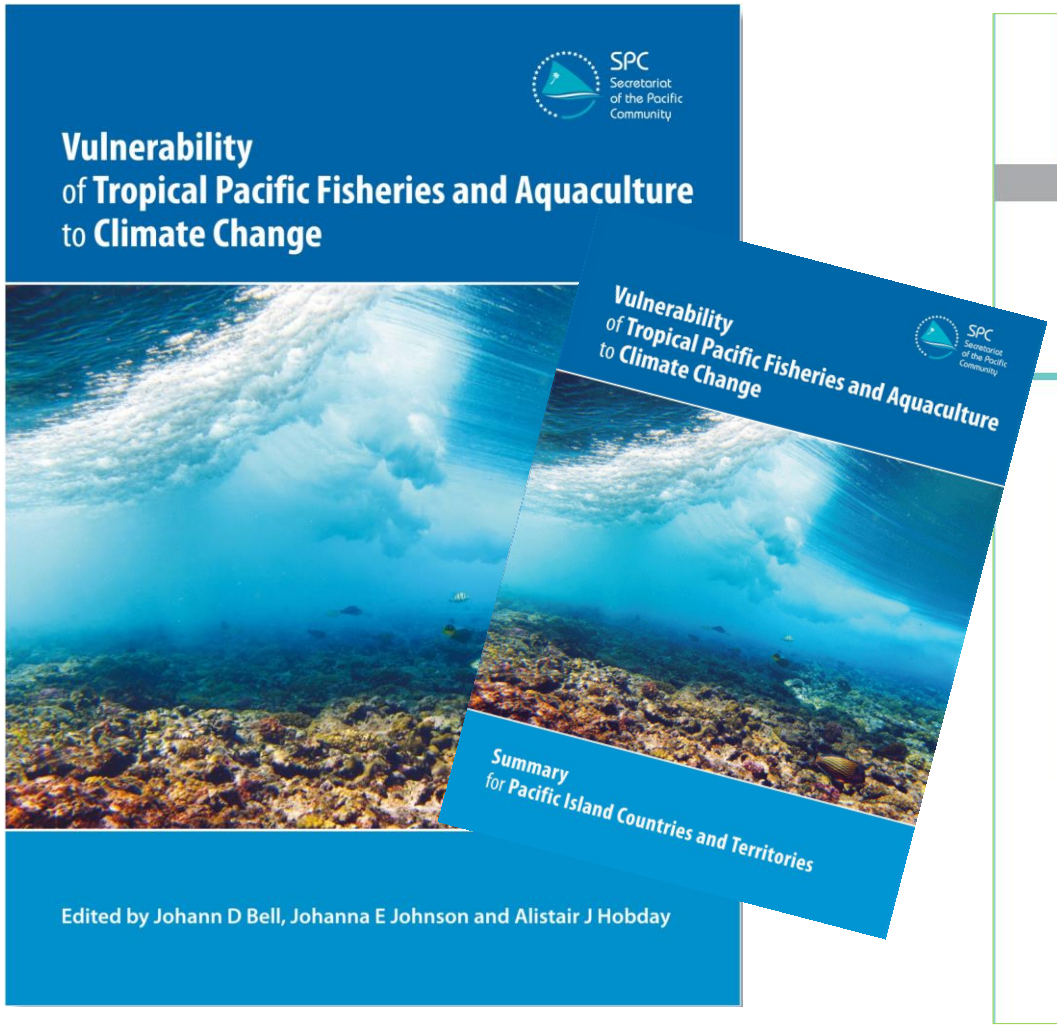
4. Food security

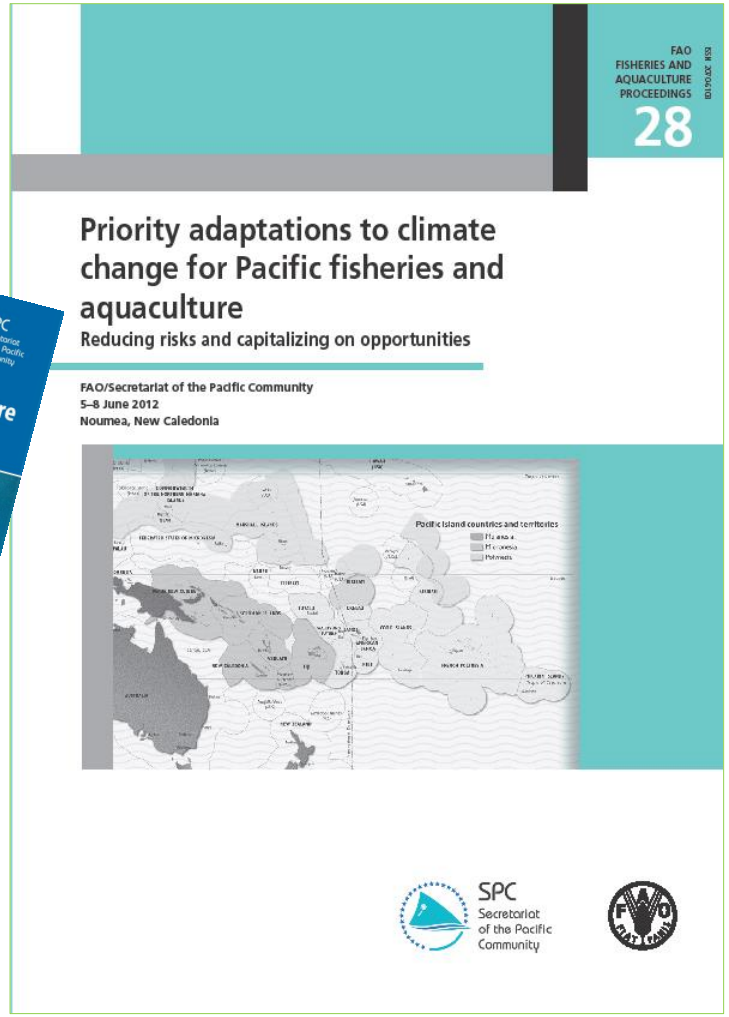
The supply of tuna for domestic consumption in the region will increase by 40,000 tonnes per year by 2024, to provide nutritious food and reduce pressure on inshore resources. Depending on national circumstance, small-scale catches, supplies from processors in the region, and by-catch from industrial vessels will all contribute to this increase.

Supporting policies for economic development

- **Existing policies**
  - Economic partnership agreement with EU
- **Potential policies**
  - Incentives for start-ups to add value to skipjack tuna
  - Use of licence conditions to deliver fish needed by national canneries

Further information





http://www.spc.int/en/our-work/climate-change/introduction.html