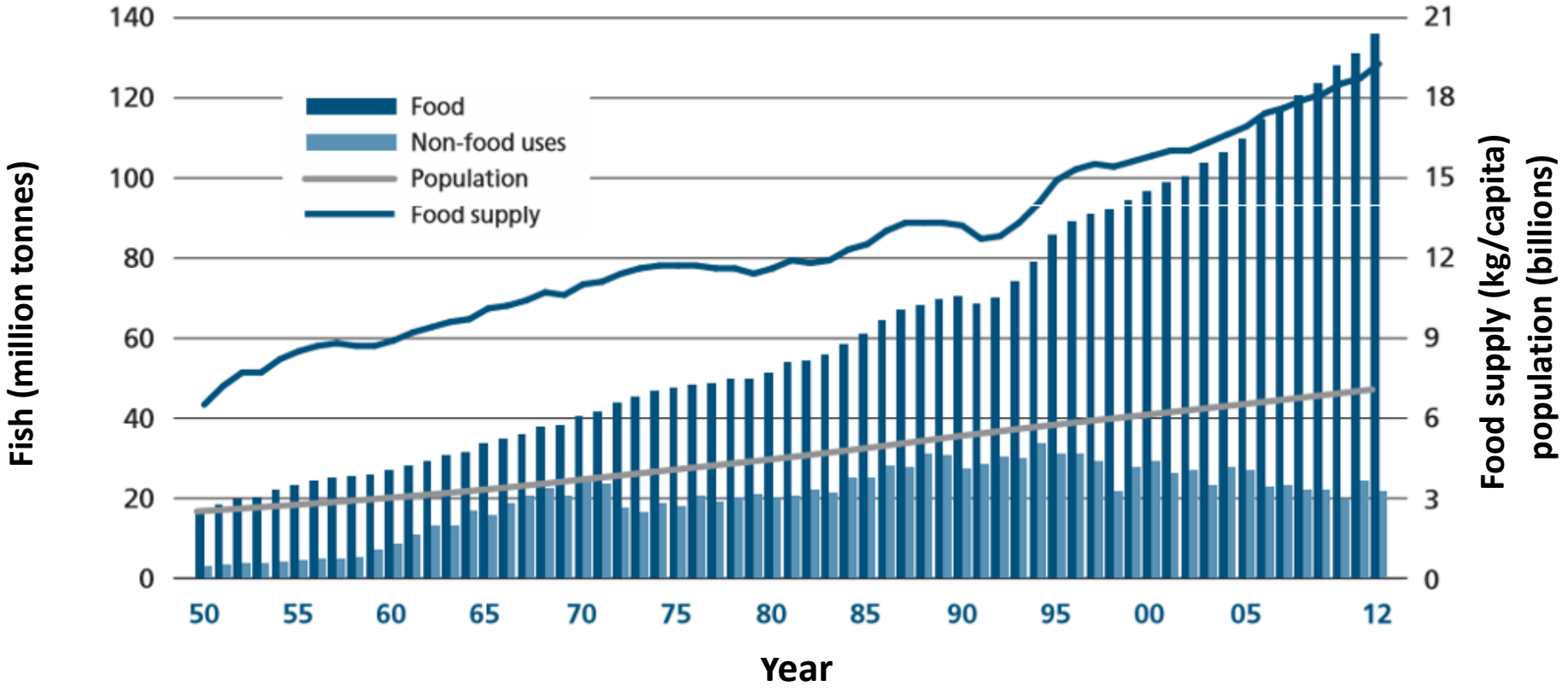
Effects of climate change on contributions of fisheries and aquaculture to food security

Johann Bell

Fish and food security

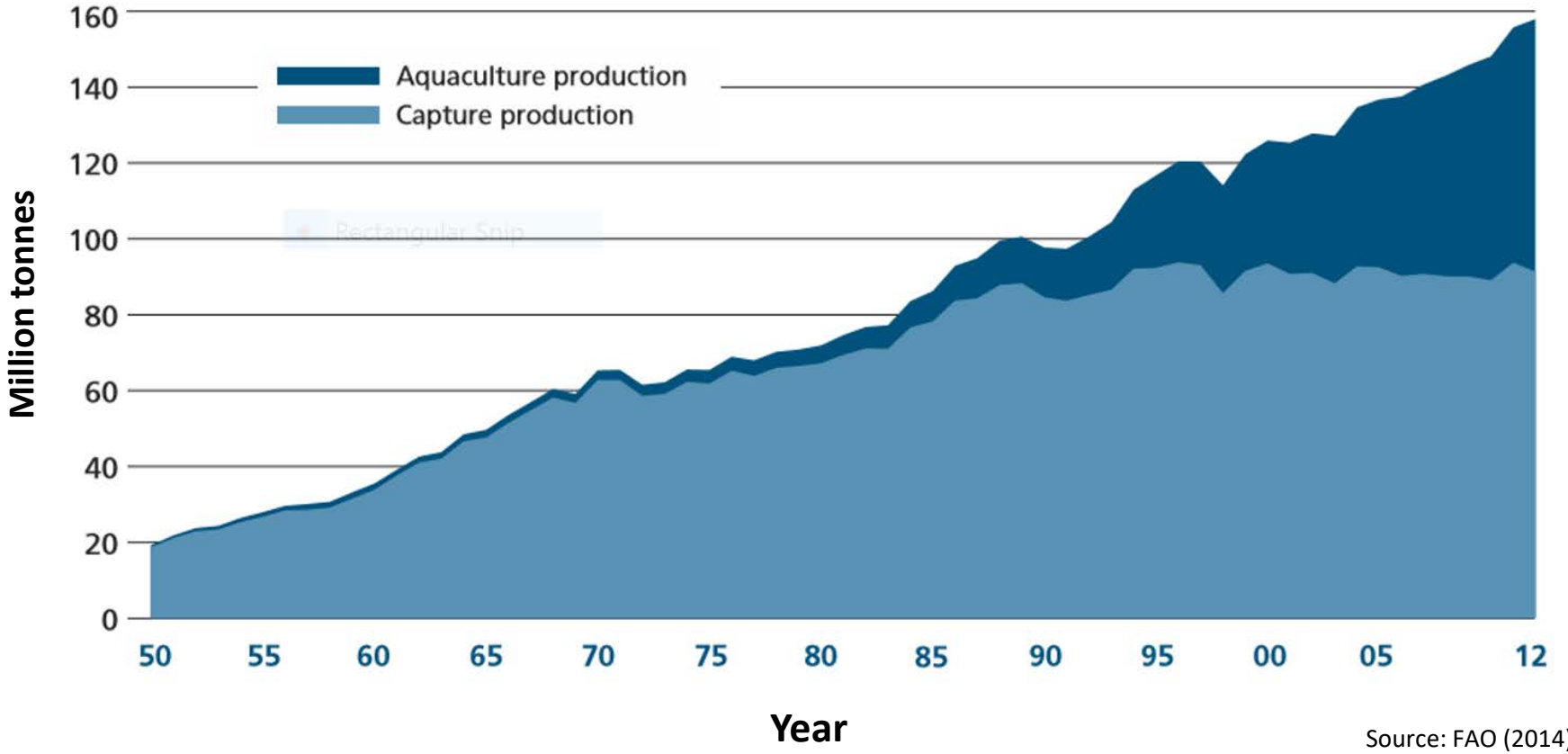
- 130 million mt of fish is used directly for food and provides 4.5 billion people with 15% of their dietary animal protein



Source: FAO (2014), Bene et al. (2015)

Fish and food security

- Supply of fish is outpacing other sources of animal protein, but only due to rapid growth of aquaculture



Source: FAO (2014)

Future needs

- An additional 75 million tonnes of fish will be required to provide > 9 billion people with 20% of their dietary protein by 2050

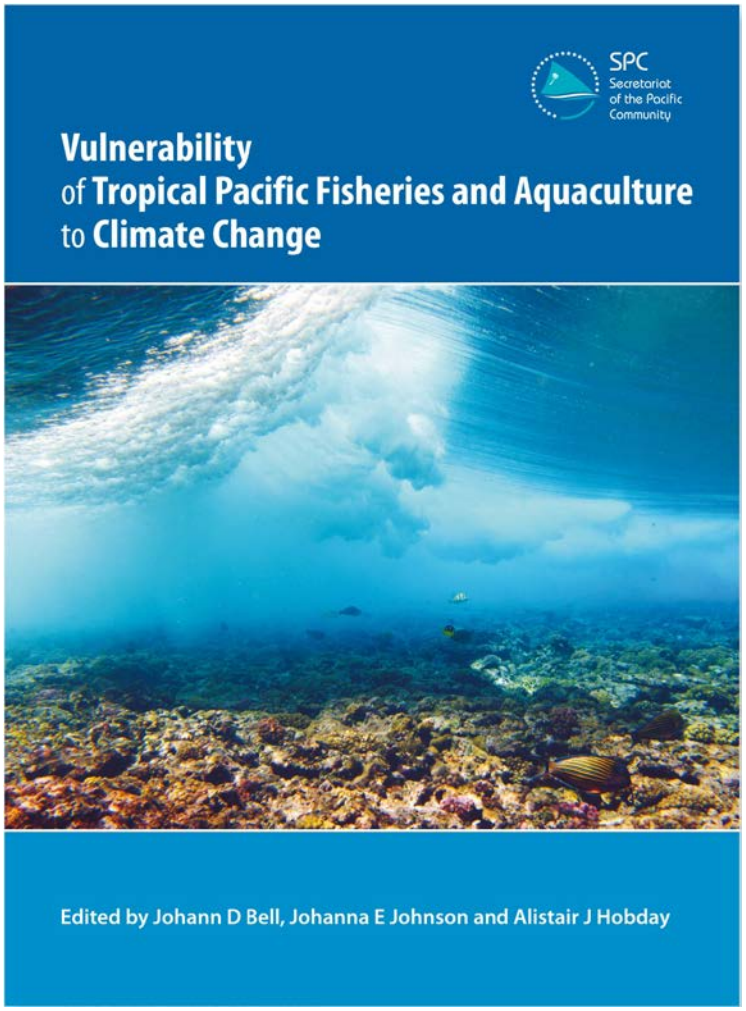
- Optimism that this can be achieved by:
  - Improvements to aquaculture - feed formulation, feeding technologies, farm management, selective breeding
  - better management of fisheries and the habitats on which they depend

Source: Rice and Garcia (2011); FAO (2014)

Key questions

- How is climate change likely to affect the plans being made to provide the additional fish required?
- What adaptations will be needed to reduce the risks and capitalise on the opportunities?

Pacific Islands assessment

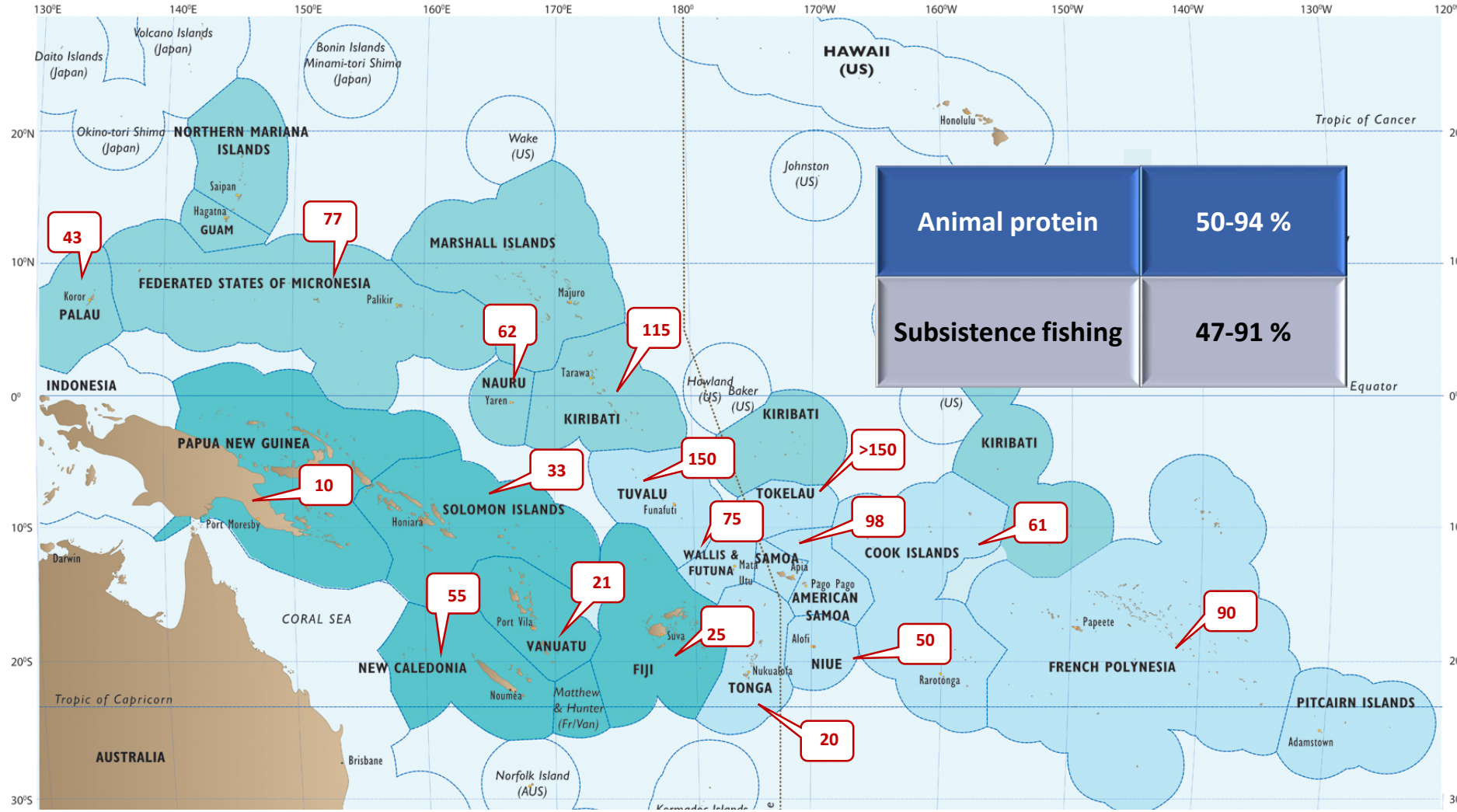


- 22 countries and territories
- 36 institutions
- 90 scientists and managers

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

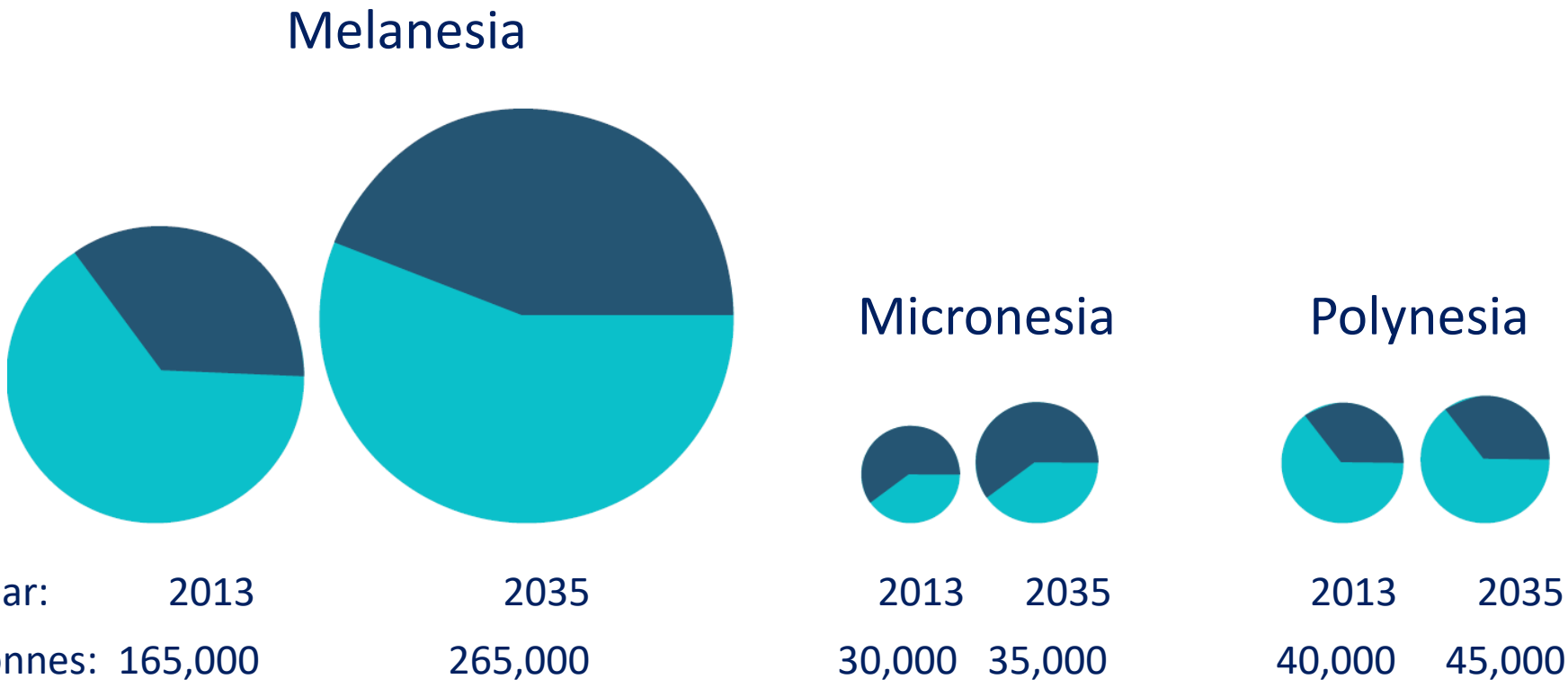
Focus on food security

- Fish consumption in rural areas (kg/person/year)



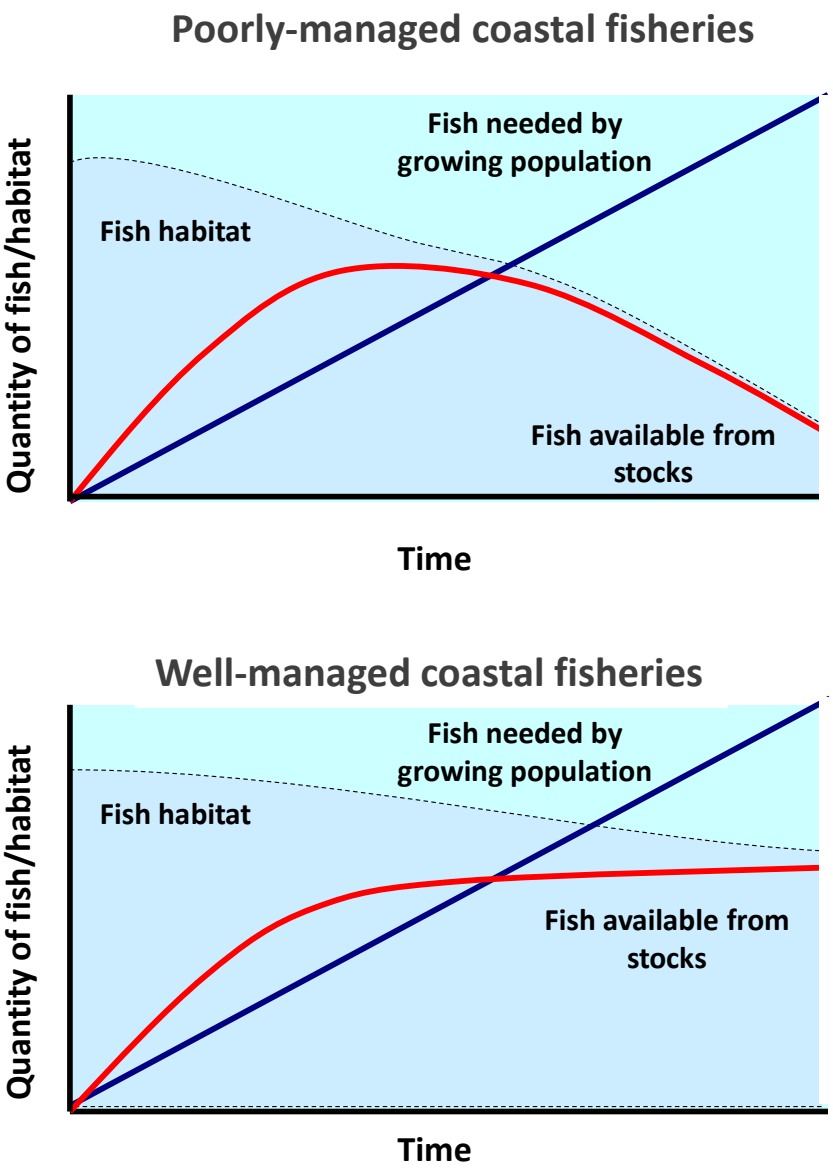
Source: Bell et al. (2009), Gillett (2009)

Fish needed in the future



Source: Bell et al. (2015)

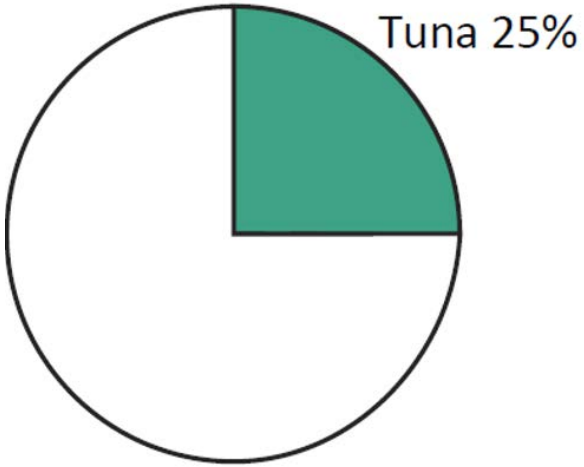
Strategic plans to provide more fish



Source: Bell et al. (2011)

Quantity of tuna needed

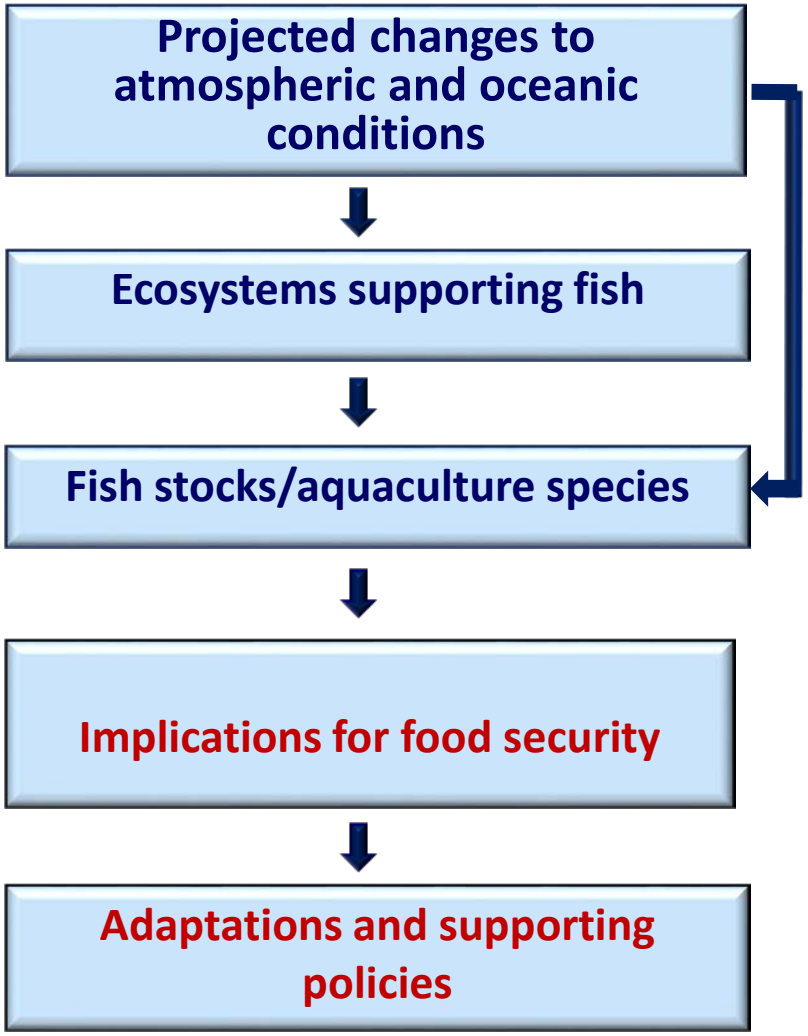
Total tuna catch from
Pacific Island EEZs
= 1.5 million Mt p.a.



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

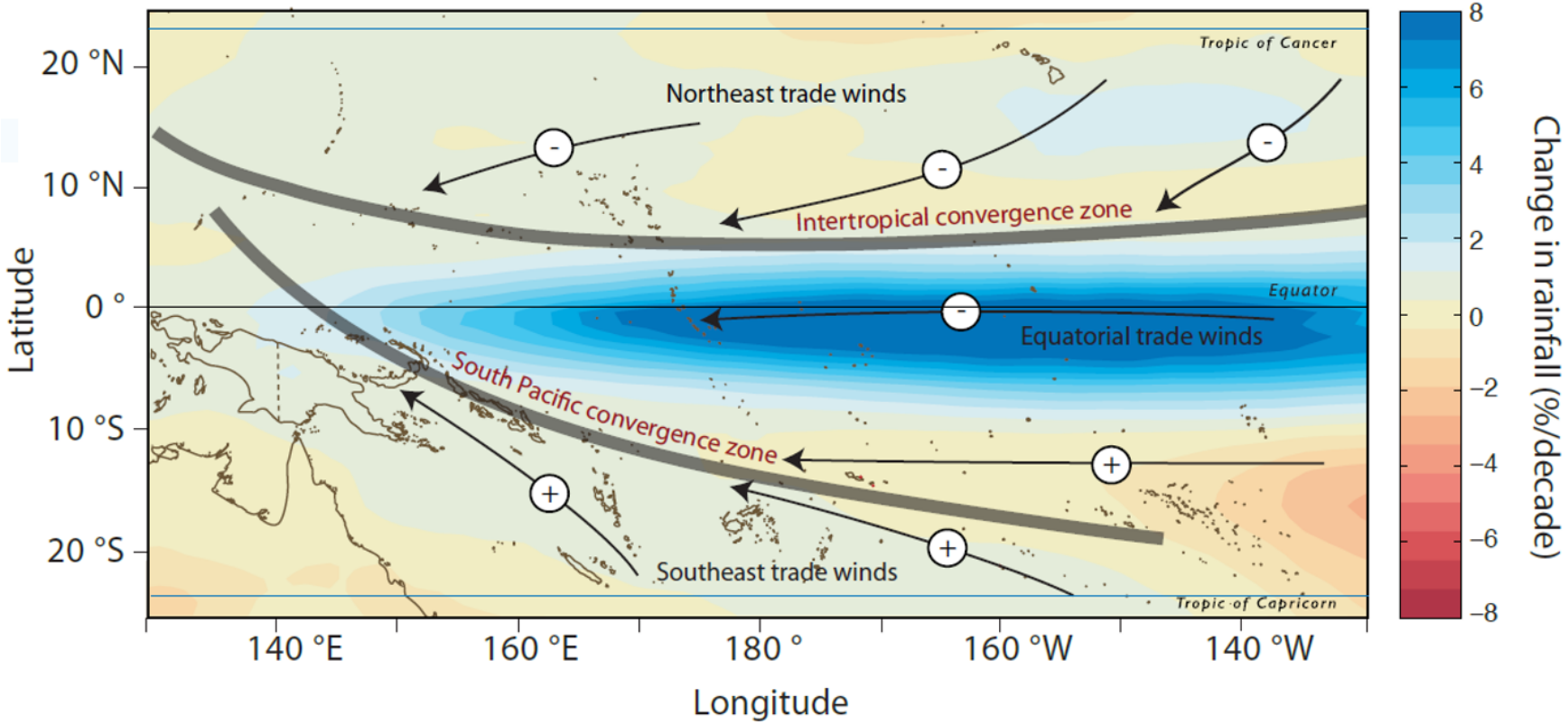
Source: Bell et al. (2015)

Approach used for assessment



Projected changes in rainfall

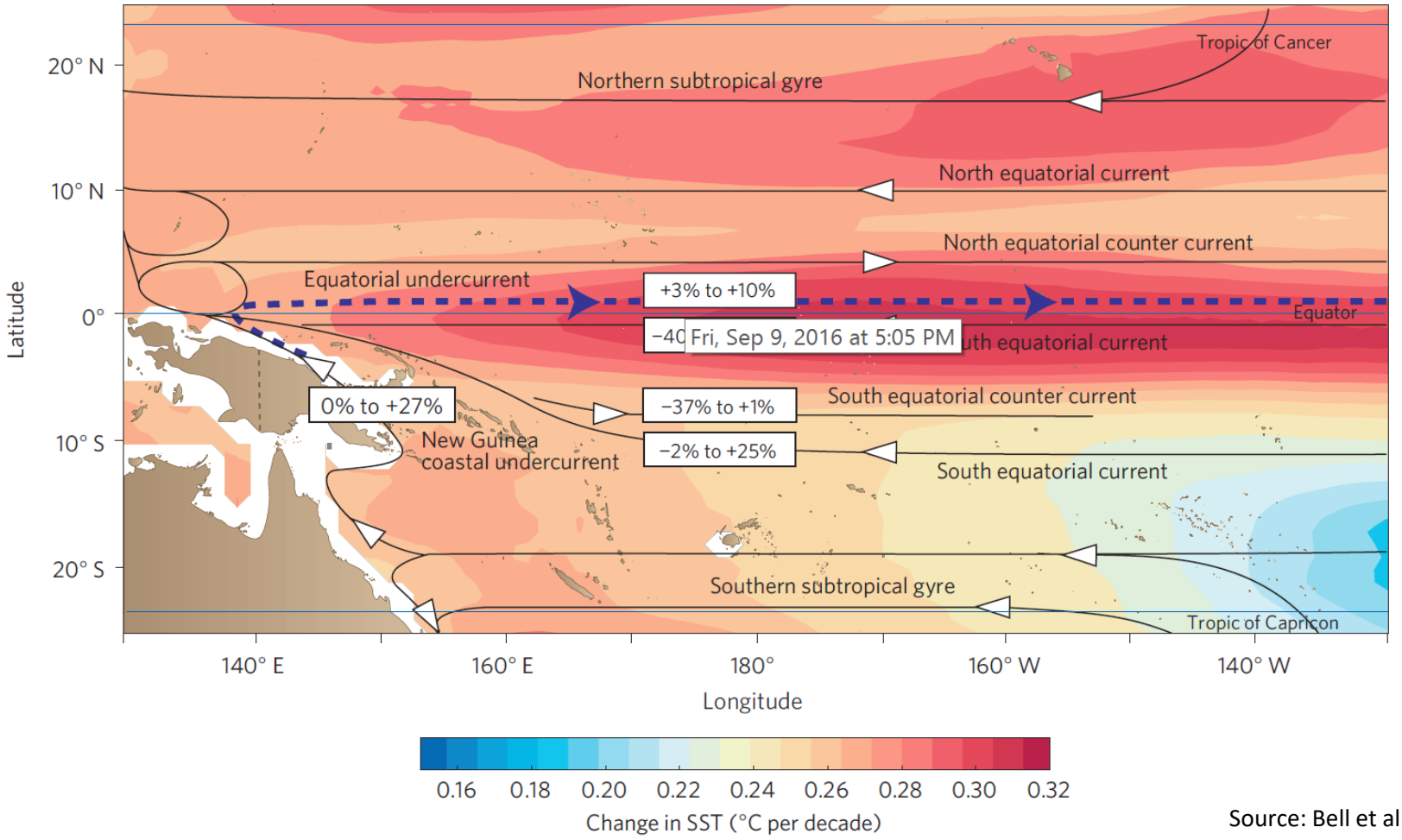
- High emissions scenario



Source: Bell et al. (2013)

Changes in SST and ocean currents

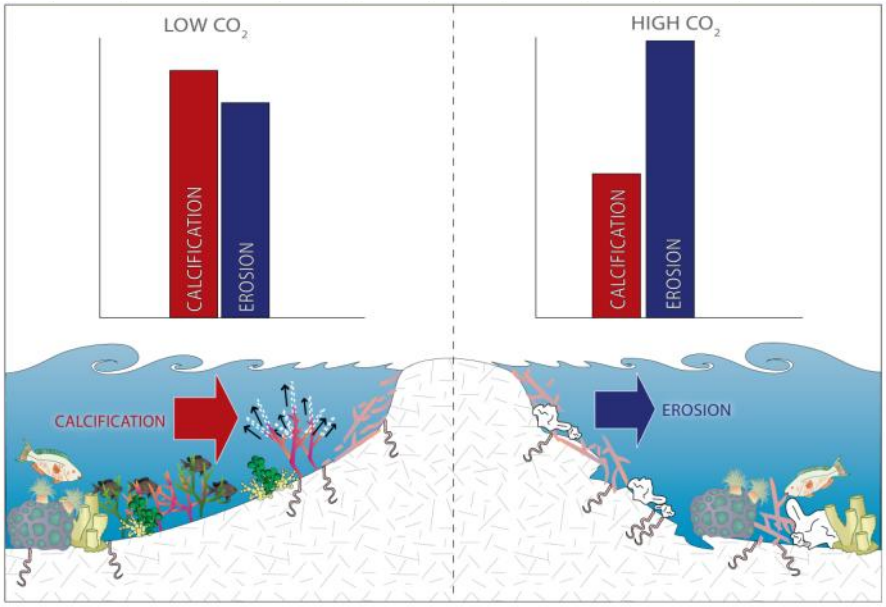
- High emissions scenario, 2100



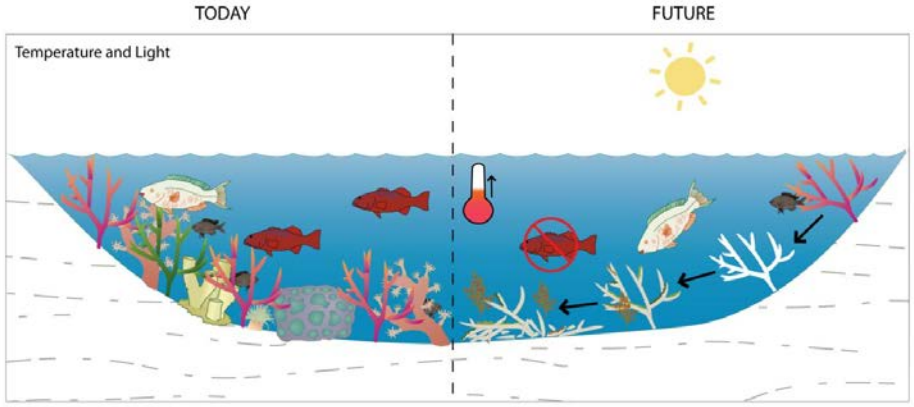
Source: Bell et al. (2013)

Changes to coral reefs

Ocean acidification

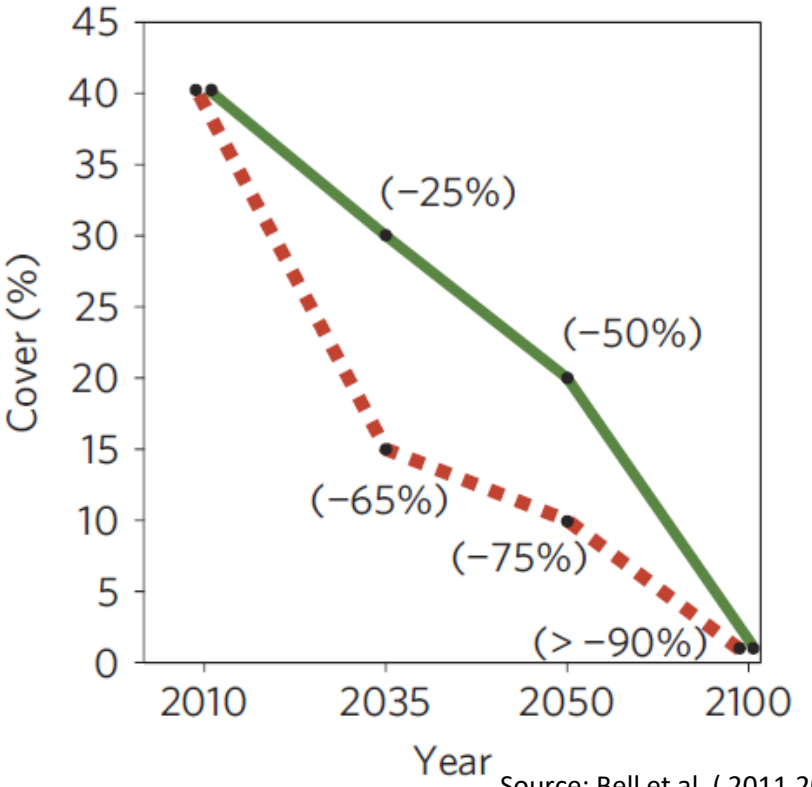


Sea surface temperature



Live coral cover

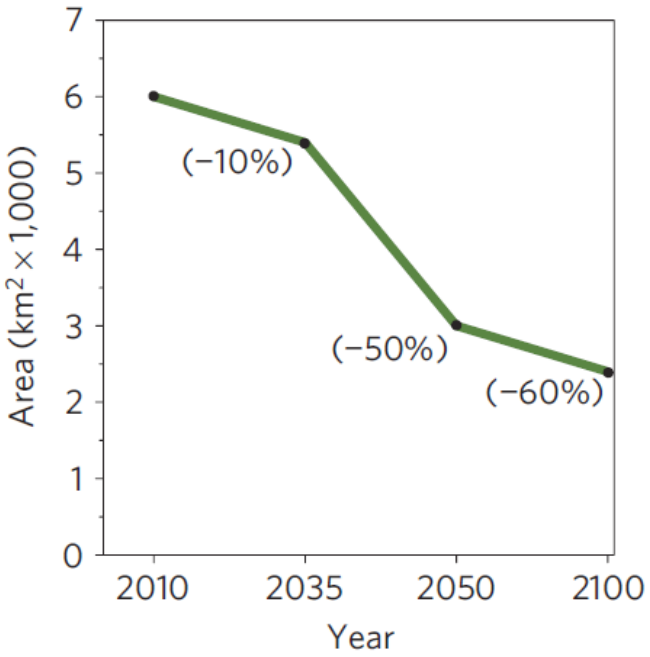
- High emissions scenario



Source: Bell et al. (2011,2013)

Changes to mangroves

- Most vulnerable to:
  - sea-level rise
  - increasing storm intensity



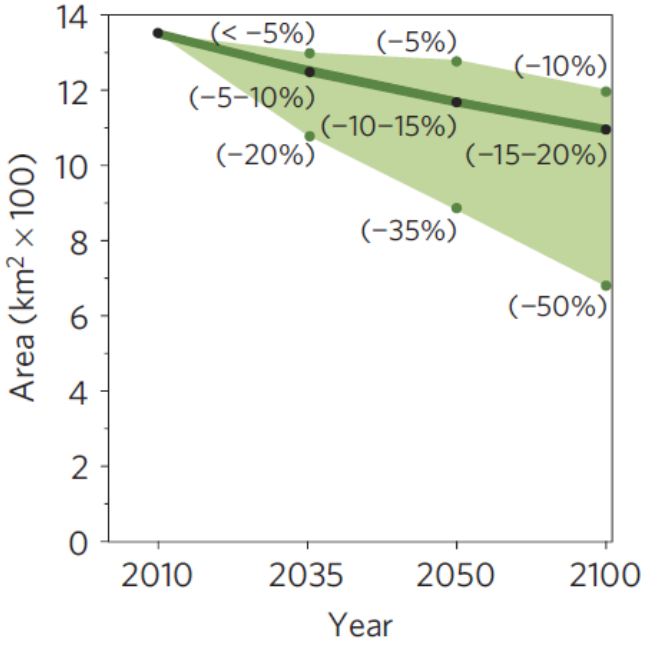
Mangrove area

- High emissions scenario

Source: Bell et al. (2013)

Changes to seagrass

- Most vulnerable to:
  - Warmer waters
  - Increased rainfall (turbidity)
  - Increasing storm intensity

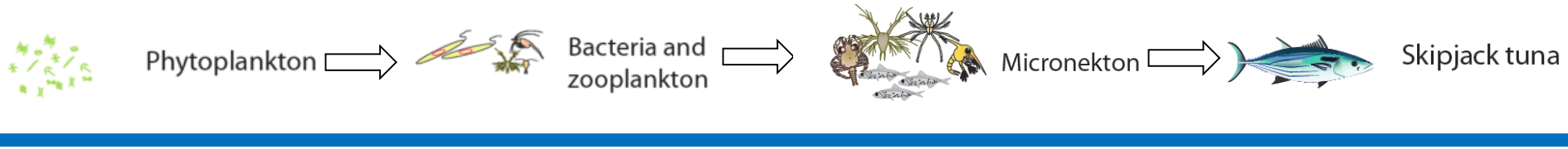


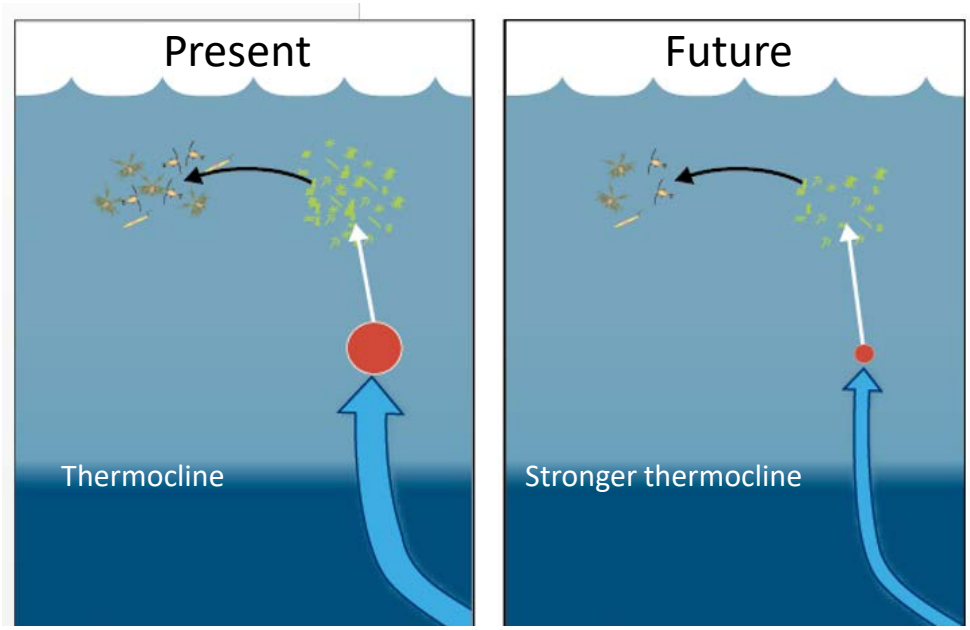
Seagrass area

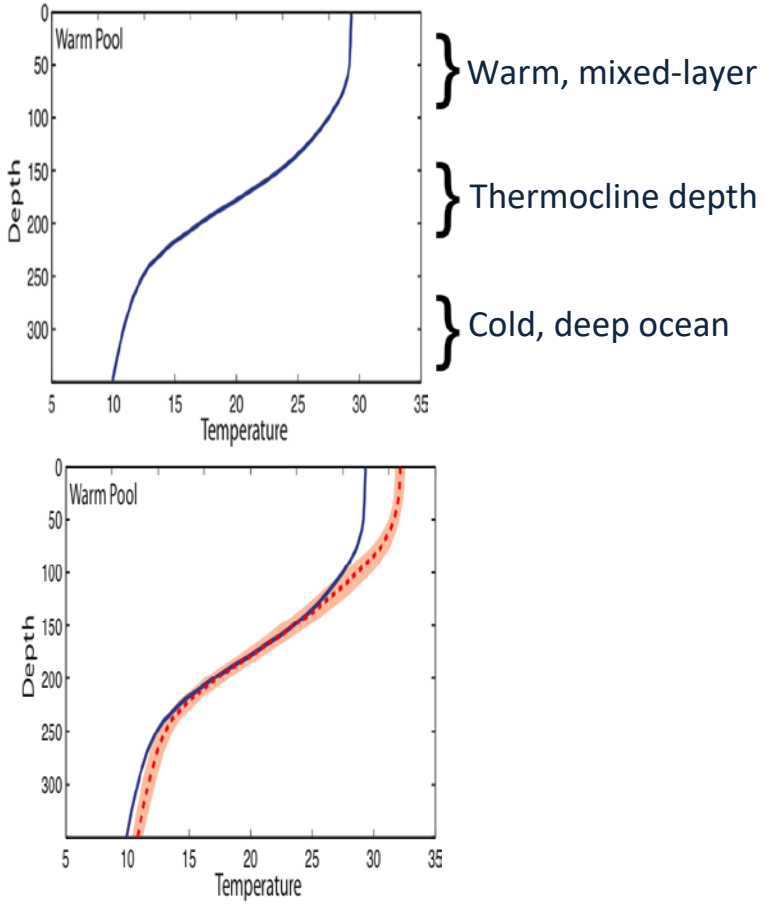
- High emissions scenario

Source: Bell et al. (2013)

Food webs supporting tuna

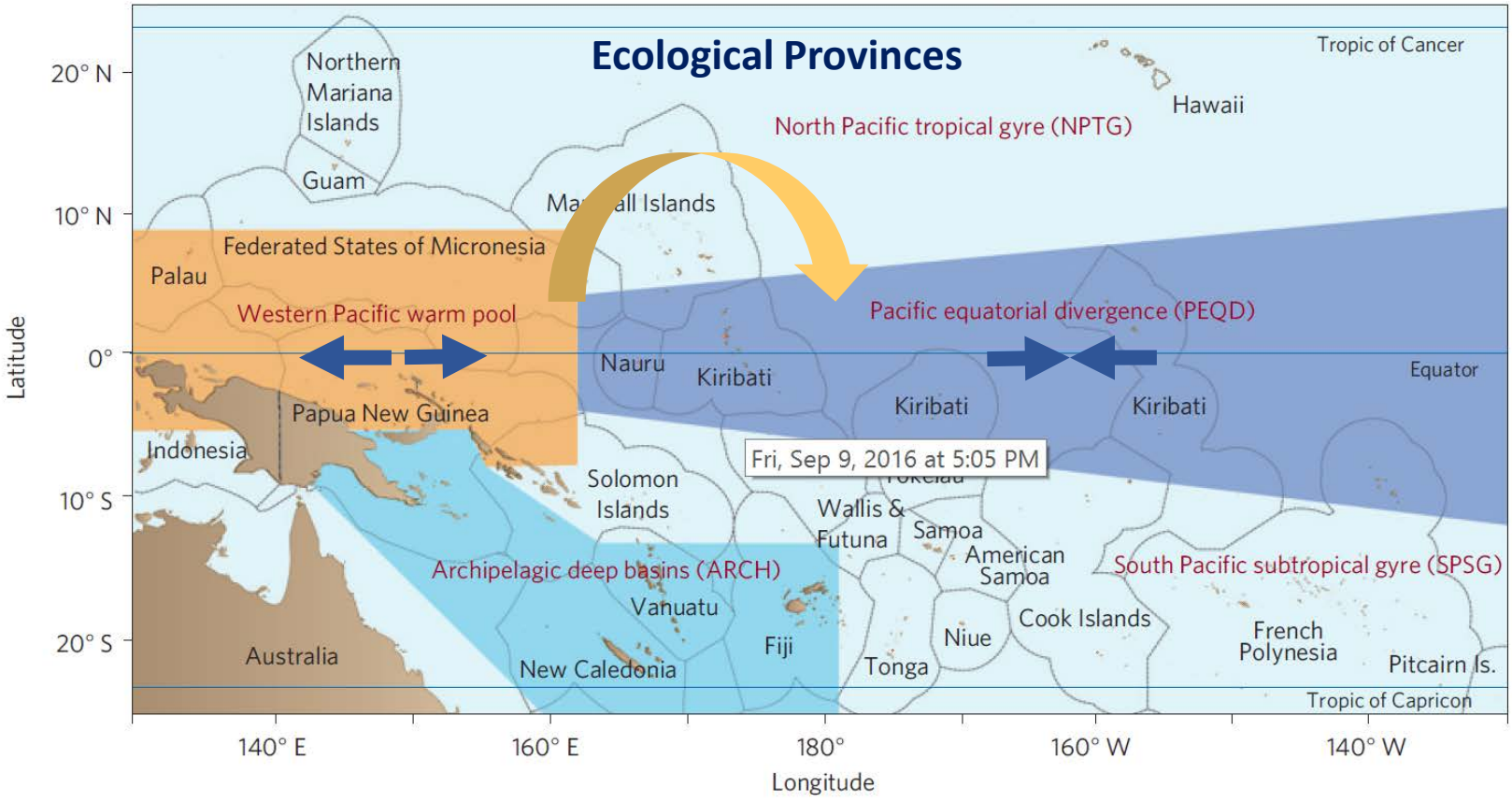




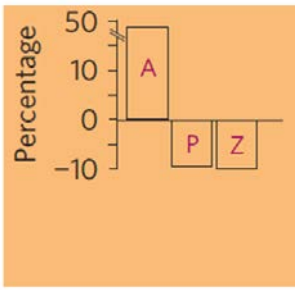


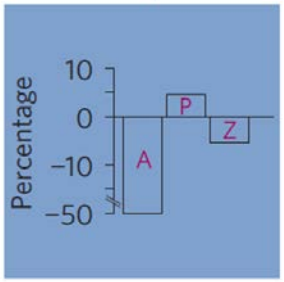
Source: Le Borgne et al. (2011)

Changes to food webs for tuna



- Changes in area (A), net primary production (P) and zooplankton biomass (Z)
- High emissions scenario, 2100





Source: Bell et al. (2013)

Effects on fish stocks

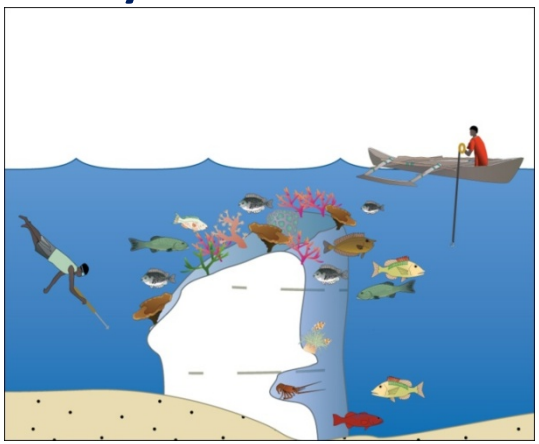
Will be a combination of:

- Direct effects due to changes in physical and chemical nature of the ocean
- Indirect effects due to changes in fish habitat

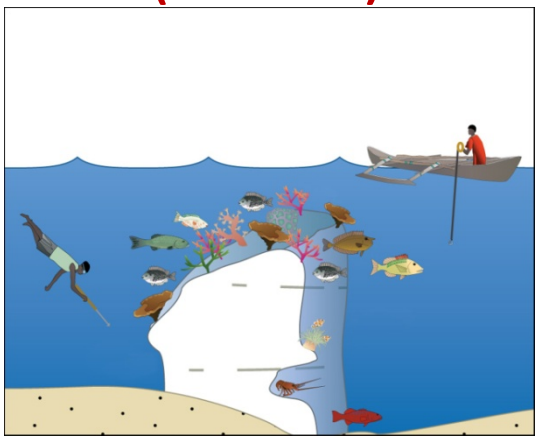
Changes to coastal fisheries

- High emissions scenario

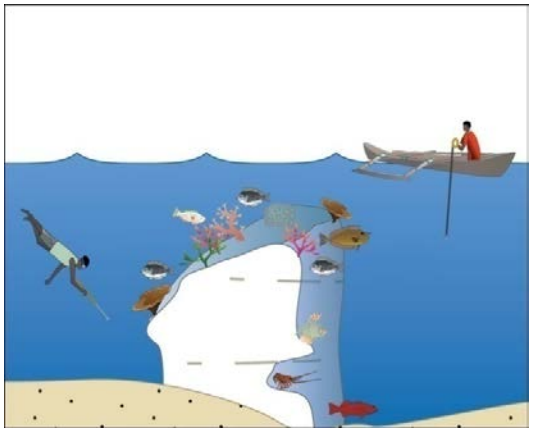
Today



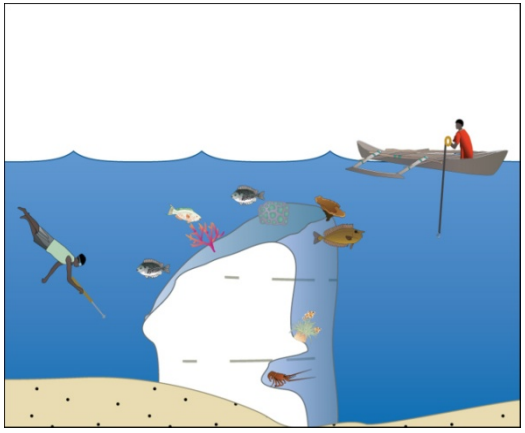
2035 (-2 to -5%)



2050 (-20%)



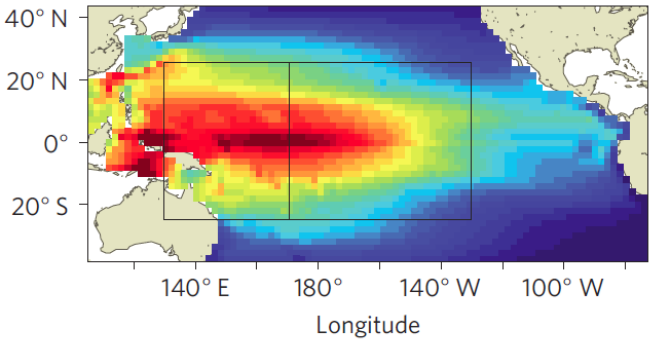
2100 (-20 to -50%)



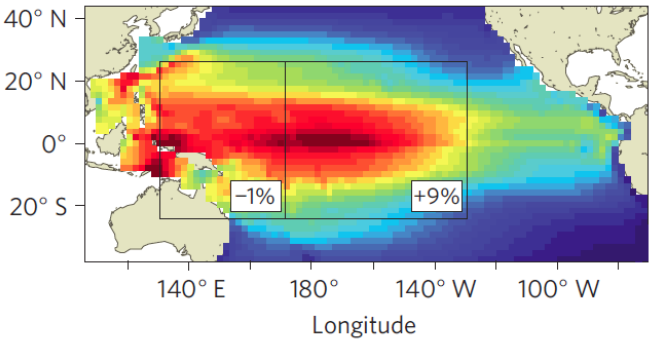
Skipjack tuna

- High emissions scenario

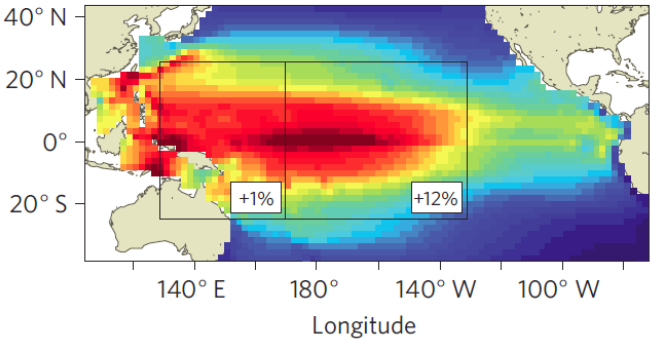
2005



2035

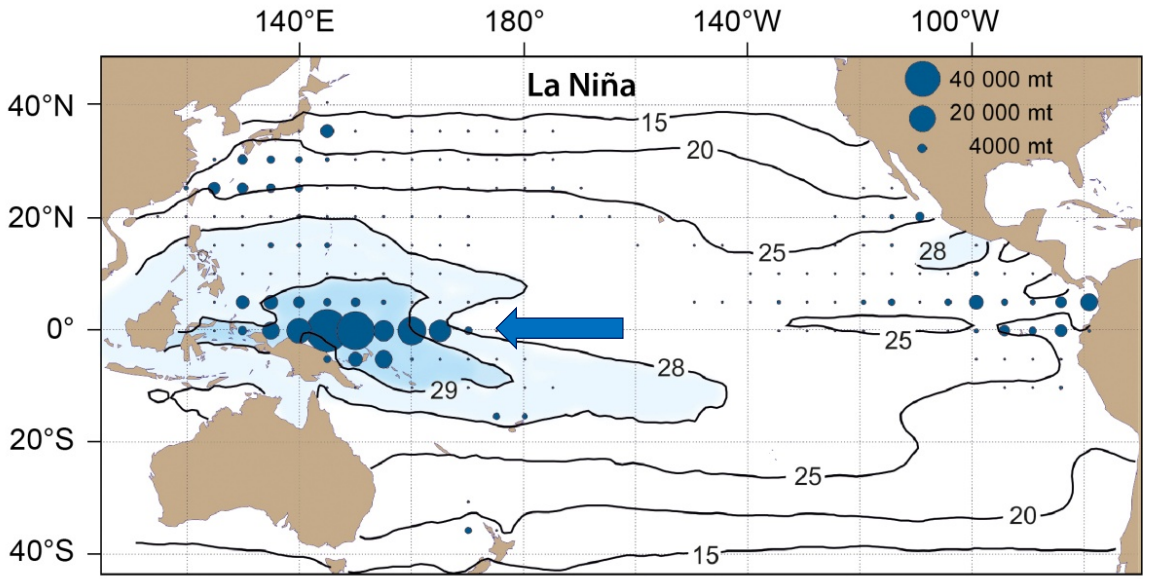


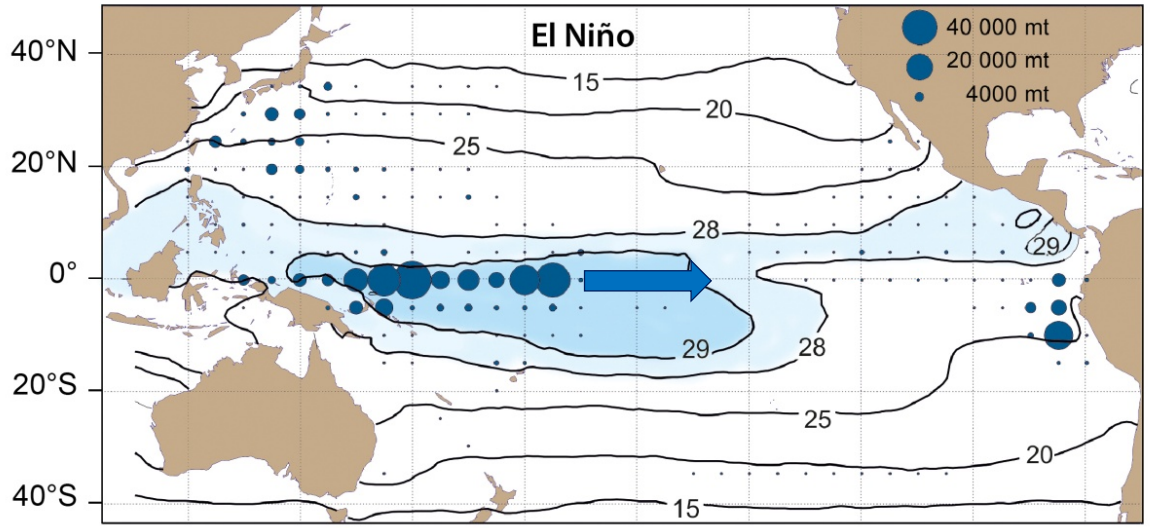
2050



Source: Lehodey et al. (2013), Bell et al. (2013)

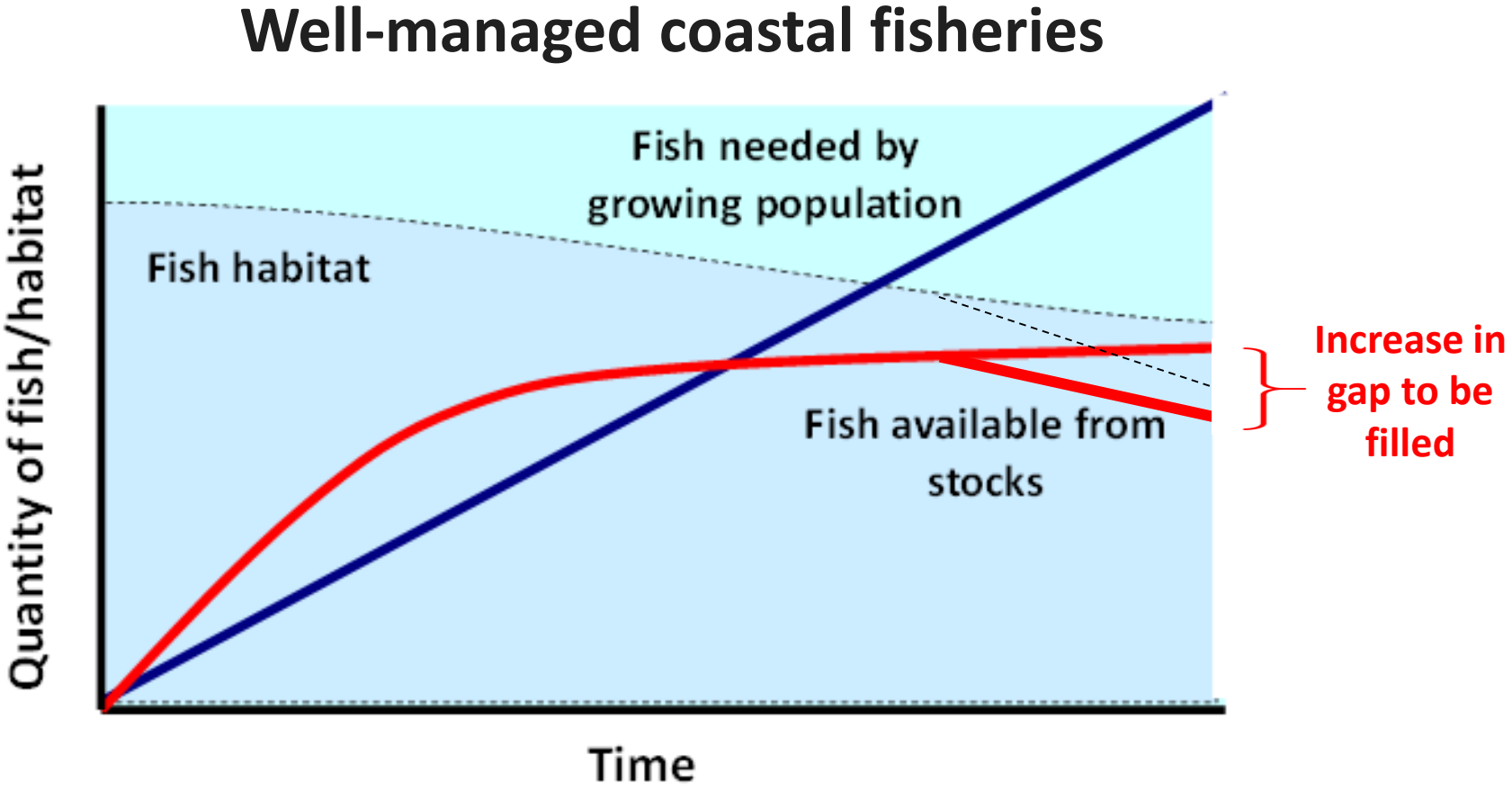
Effects of ENSO on skipjack tuna





Source: Lehodey et al. (1997)

Implications for plans to increase access to fish for food security

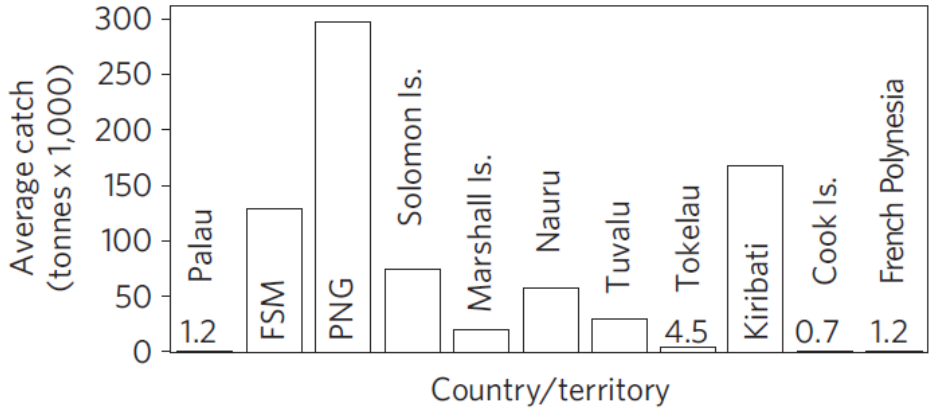


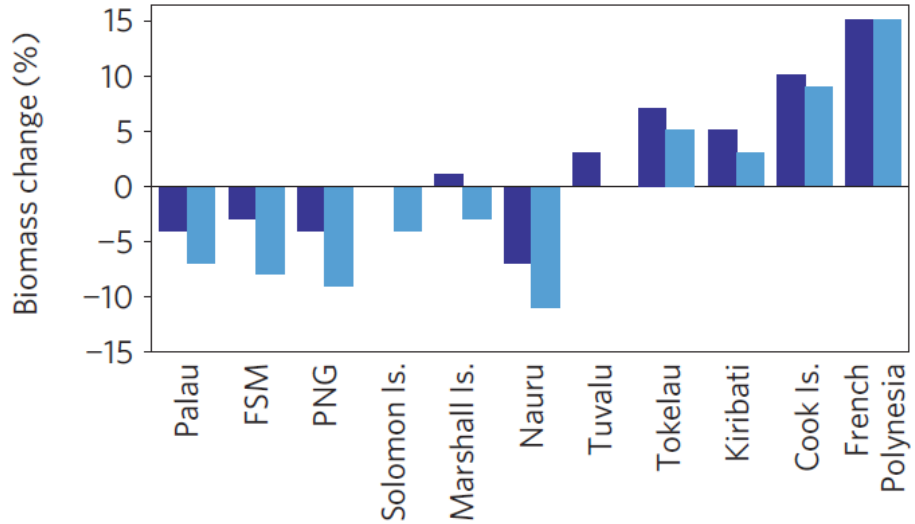
Implications for plans to increase access to fish for food security

2005

Skipjack tuna

2035





Unexploited

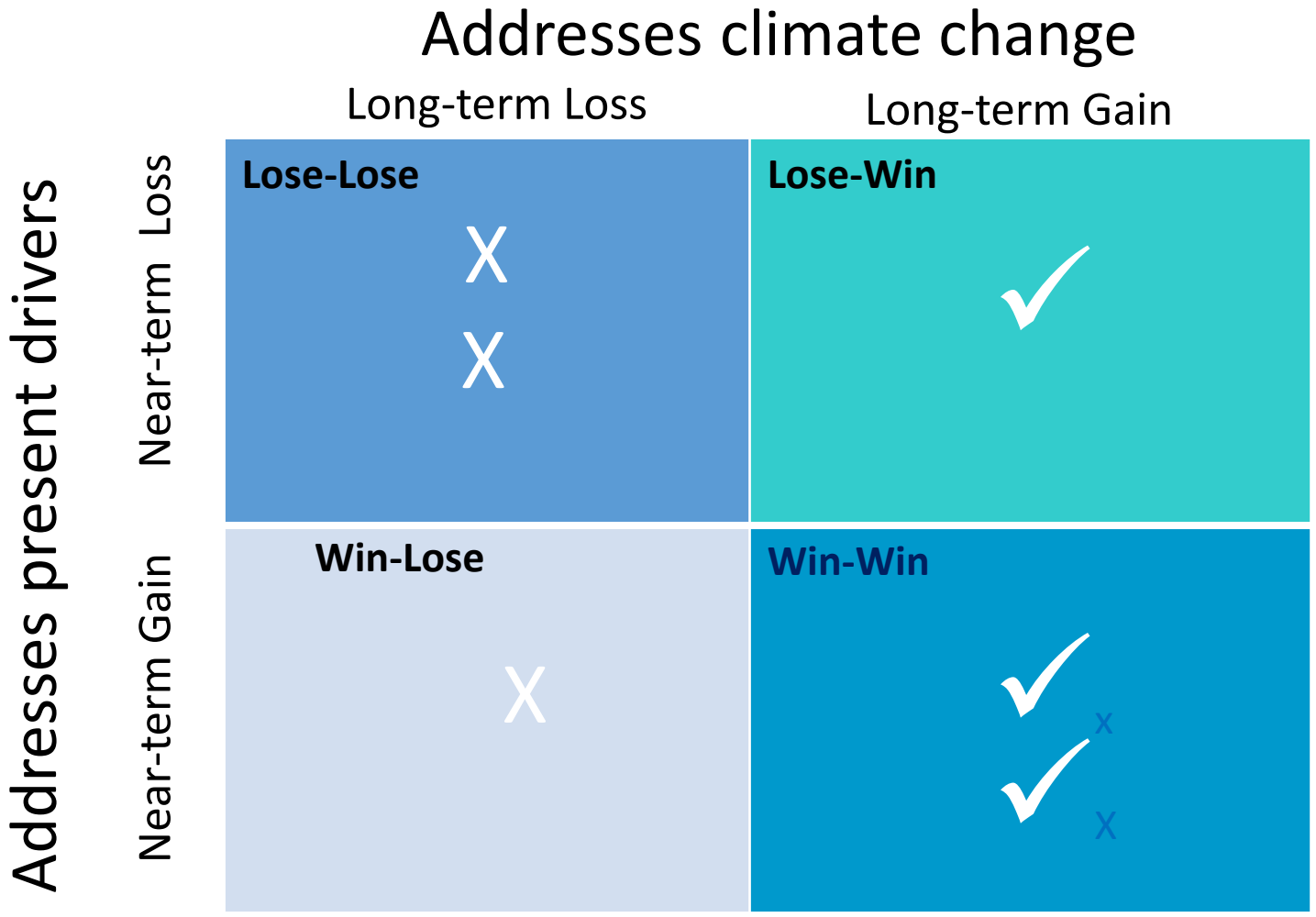
Fishing effort x 1.5

Source: Bell et al. (2013)

Adaptation priorities

- Minimize the gap in fish supply
- Fill the gap

Adaptation framework



After Grafton (2010)

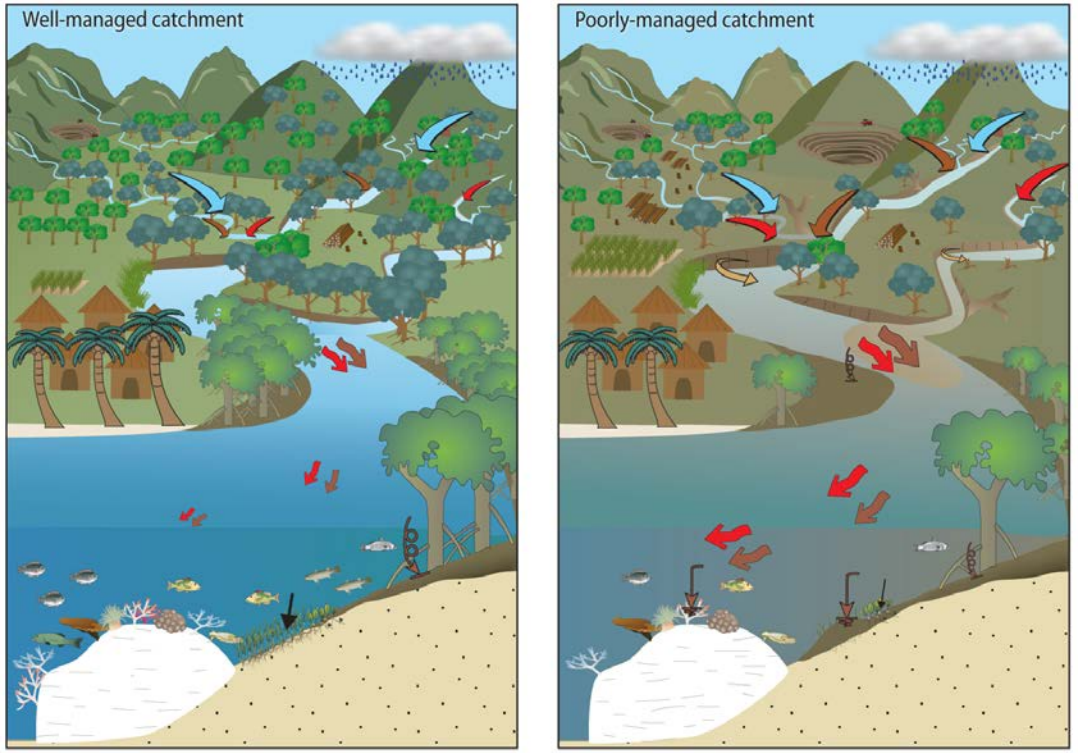
Adaptations to minimise the gap

Enhance resilience of fish habitats

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

Manage and restore vegetation cover in catchments

Improves resilience of coral reef, mangrove and seagrass habitats

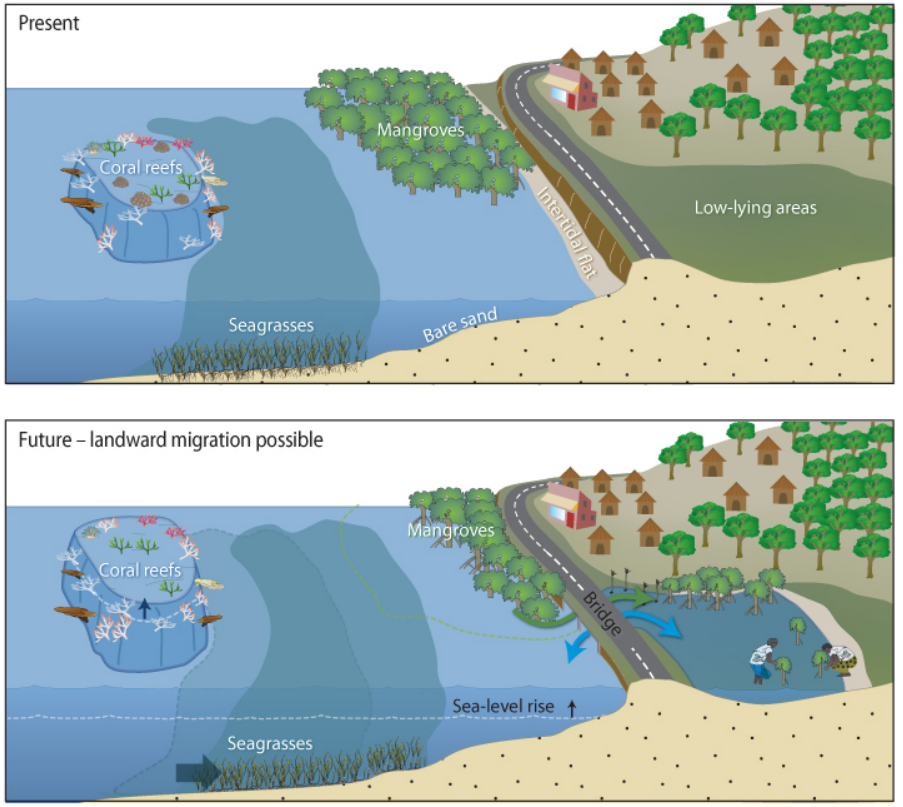


Source: Bell et al. (2011)

Enhance resilience of fish habitats

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

Provide for landward migration of coastal fish habitats



Source: Bell et al. (2011)

Enhance resilience of fish stocks

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

Sustain production of coastal fish stocks with precautionary harvests

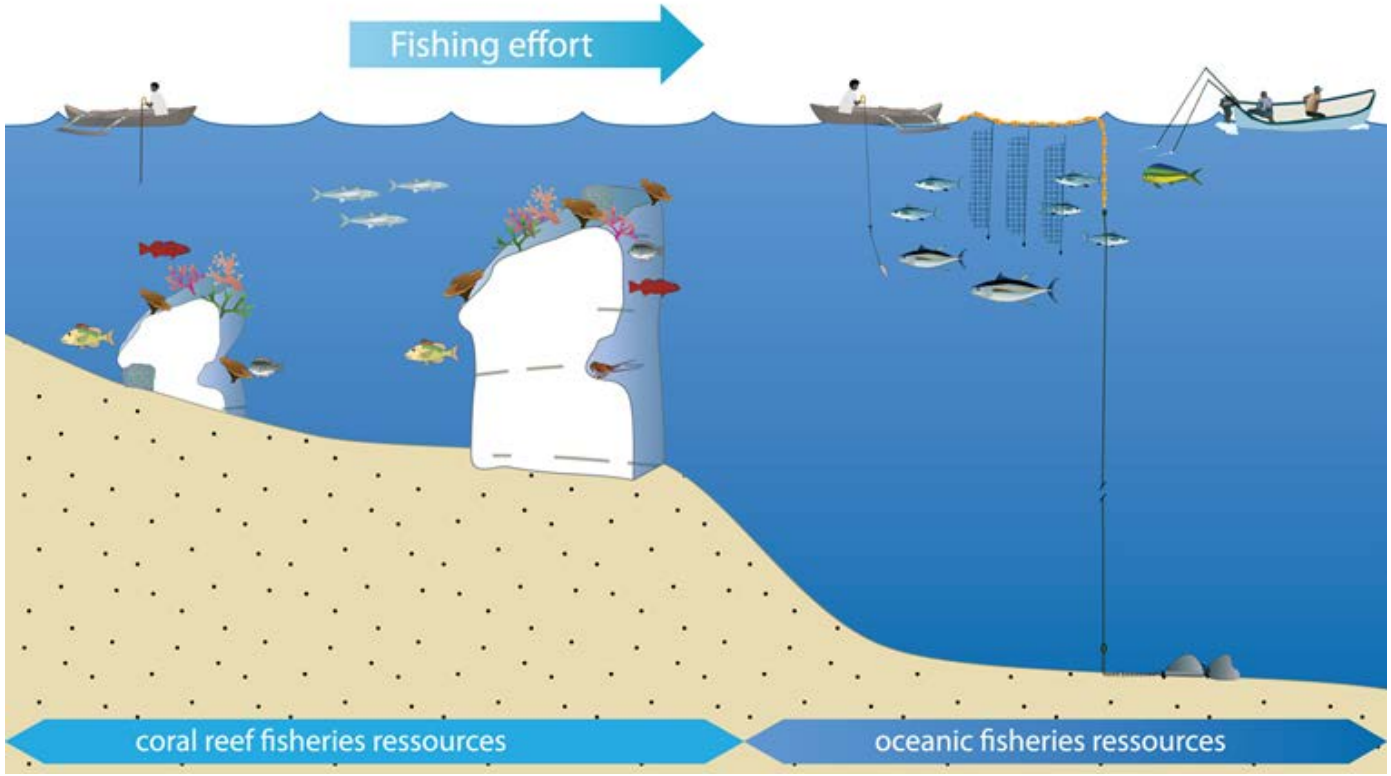
Maintaining spawning adults will help ensure replenishment and build resilience of key species

Adaptations to fill the gap

Increase access to tuna

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

Transfer fishing effort from coral reefs to tuna using nearshore Fish Aggregating Devices (FADs)



Source: SPC (2014)

Increase access to tuna

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

Distribute small tuna obtained from transshipping operations

Expand pond aquaculture

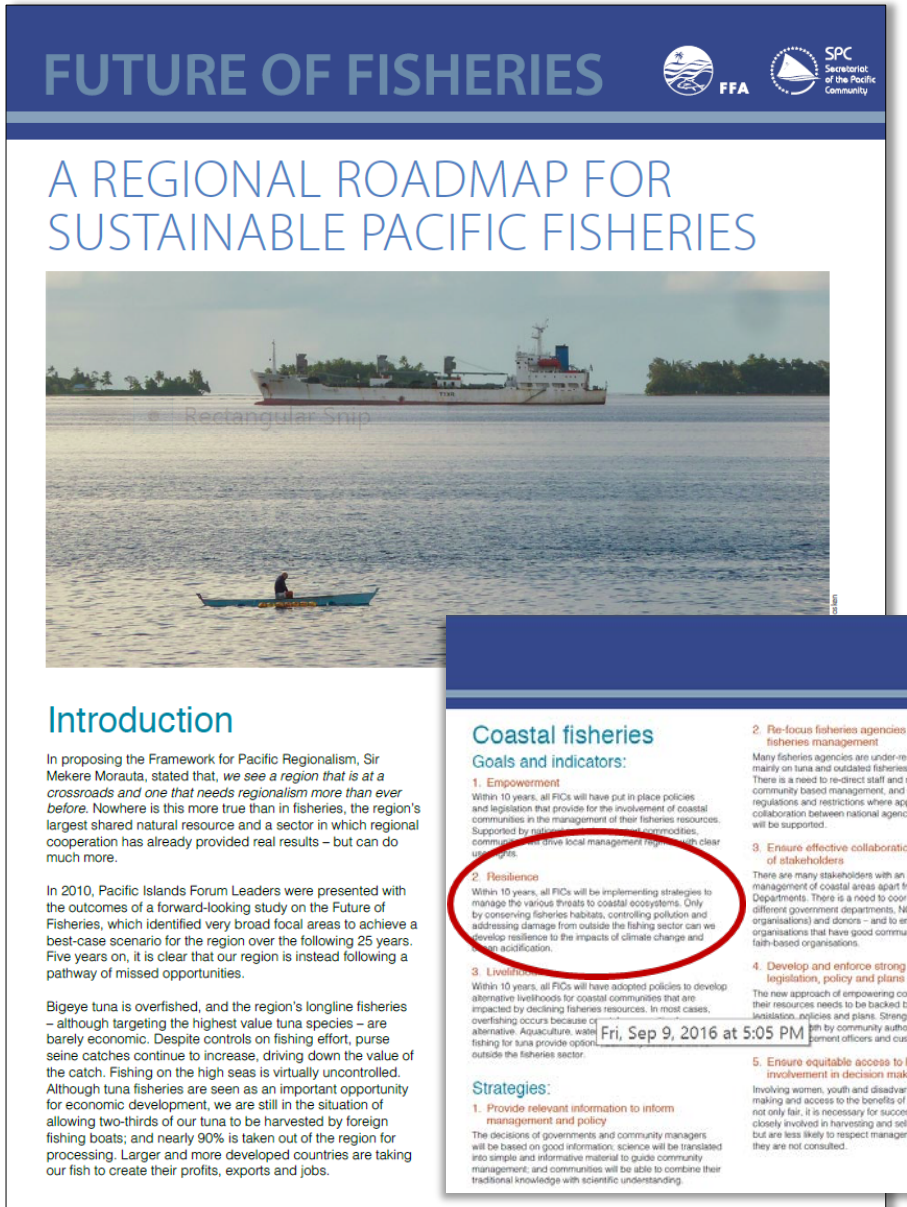
L-L	L-W
W-L	W-W

Scale-up development of tilapia farming

Supporting Policies

Habitat resilience

- Manage the various threats to coastal ecosystems by reforming farming, forestry and mining practices
- Control pollution and waste disposal
- Institute cross-sectoral planning to avoid maladaptation



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 fishing boats; and nearly 90% is taken out of the region for processing. Larger and more developed countries are taking our fish to create their profits, exports and jobs.

Coastal fisheries

Goals and indicators:

1. Empowerment

Within 10 years, all FICs will have put in place policies and legislation that provide for the involvement of coastal communities in the management of their fisheries resources.

2. Resilience

Within 10 years, all FICs will be implementing strategies to manage the various threats to coastal ecosystems. Only by conserving fisheries habitats, controlling pollution and addressing damage from outside the fishing sector can we develop resilience to the impacts of climate change and ocean acidification.

3. Livelihoods

Within 10 years, all FICs will have adopted policies to develop alternative livelihoods for coastal communities that are impacted by declining fisheries resources. In most cases, overfishing occurs because of

Fri, Sep 9, 2016 at 5:05 PM

alternative. Aquaculture, wate

fishing for tuna provide option

outside the fisheries sector.

Strategies:

1. Provide relevant information to inform management and policy

The decisions of governments and community managers will be based on good information; science will be translated into simple and informative material to guide community management; and communities will be able to combine their traditional knowledge with scientific understanding.

2. Re-focus fisheries agencies t

fisheries management

Many fisheries agencies are under-res

mainly on tuna and outdated fisheries

There is a need to re-direct staff and re

community based management, and e

regulations and restrictions where app

collaboration between national agencie

will be supported.

3. Ensure effective collaboration

of stakeholders

There are many stakeholders with an i

management of coastal areas apart fr

Departments. There is a need to coord

different government departments, NG

organisations) and donors – and to en

organisations that have good commun

faith-based organisations.

4. Develop and enforce strong

legislation, policy and plans

The new approach of empowering com

their resources needs to be backed by

legislation, policies and plans. Strengt

by community author

ement officers and cust

5. Ensure equitable access to b

involvement in decision maki

Involving women, youth and disadvant

making and access to the benefits of

not only fair, it is necessary for succes

closely involved in harvesting and sell

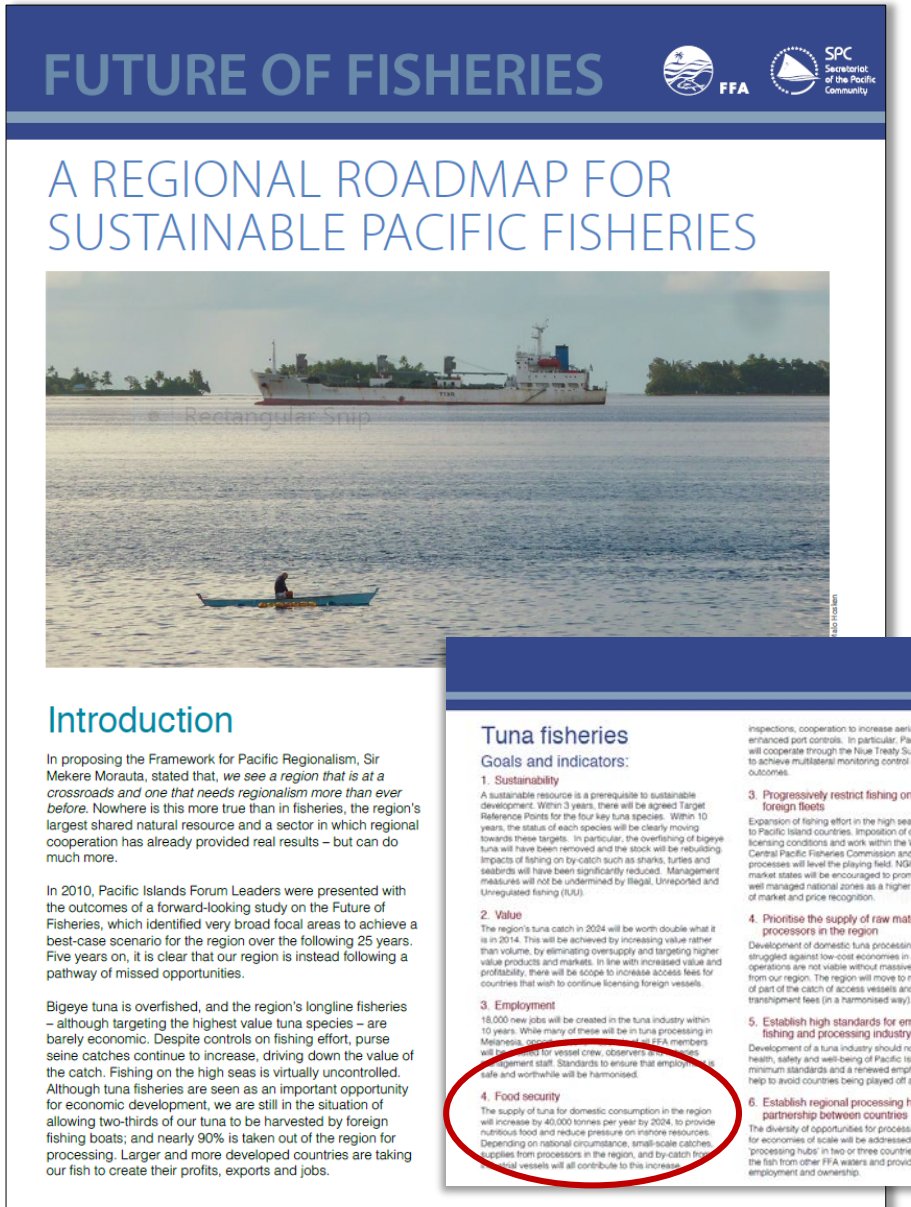
but are less likely to respect manager

they are not consulted.

Supporting Policies

Increase access to tuna

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



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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, [illegible] FFA members will be employed for vessel crew, observers and [illegible] agement staff. Standards to ensure that 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 [illegible] vessels will all contribute to this increase.

inspections, cooperation to increase aeri… enhanced port controls. In particular, Pa… will cooperate through the Niue Treaty Su… to achieve multilateral monitoring control … outcomes.

3. Progressively restrict fishing on… foreign fleets

Expansion of fishing effort in the high sea… to Pacific Island countries. Imposition of … licensing conditions and work within the … Central Pacific Fisheries Commission and… processes will level the playing field. NGC… market states will be encouraged to prom… well managed national zones as a higher … of market and price recognition.

4. Prioritise the supply of raw mat… processors in the region

Development of domestic tuna processin… struggled against low-cost economies in … operations are not viable without massive … from our region. The region will move to r… of part of the catch of access vessels and… transhipment fees (in a harmonised way).

5. Establish high standards for em… fishing and processing industry

Development of a tuna industry should n… health, safety and well-being of Pacific Is… minimum standards and a renewed empl… help to avoid countries being played off …

6. Establish regional processing h… partnership between countries

The diversity of opportunities for process… for economies of scale will be addressed … 'processing hubs' in two or three countrie… the fish from other FFA waters and provid… employment and ownership.

Thank you