POLICY BRIEF
24/2014
Secretariat of the Pacific Community

Pacific Island fisheries and climate change

This policy brief was prepared by the Oceanic and Coastal Fisheries Programmes of the Secretariat of the Pacific Community

Purpose

The aim of this policy brief is to:

- highlight the importance of fisheries to the people of the Pacific Islands;
- alert Pacific Island governments and their development partners to the effects of climate change and ocean acidification on the contributions of fisheries to their economies and communities; and
- identify adaptations and policies needed to reduce threats and capitalize on opportunities.

Key messages

Pacific Islands have an extraordinary dependence on fisheries for government revenue, gross domestic product, livelihoods and food security. Climate change and ocean acidification are likely to affect these socio-economic benefits – there may be winners and losers. Practical adaptations and supporting policies are available to help minimize the risks and capitalize on possible opportunities.

Nature of Pacific Island fisheries

Pacific Island countries and territories are 'large ocean states' with long coastlines relative to land area. Their natural assets support some of the largest oceanic fisheries and most diverse coastal fisheries in the world (**Figure 1**).

Oceanic fisheries consist of local and foreign industrial vessels targeting tropical tuna. The average tuna catch from Pacific Island exclusive economic zones (EEZs) is 1.4 million tonnes per year, which supplies >30% of the global tuna market.

Coastal fisheries support large numbers of subsistence and artisanal fishers who catch fish and shellfish mainly from coral reefs for livelihoods and food (see below). Overfishing has occurred in many locations. Increasingly, coastal fisheries include harvesting of tuna and other large pelagic fish from nearshore waters (i.e., overlapping with oceanic fisheries) to meet increased demands for fish.

Importance of Pacific Island fisheries

Oceanic and coastal fisheries deliver significant socio-economic benefits to the people of the Pacific. These benefits include:

- fishing access fees, which contribute 10–60% of all government revenue for six countries.
- contributions to gross domestic product (GDP) from tuna fishing and processing, but also from coastal fisheries. The value of locally-based tuna fishing alone to GDP is now USD 240 million per year.
- opportunities to earn income – 16,000 people are employed in tuna processing and industrial tuna fishing, and small-scale fisheries provide ~50% of coastal households with their first or second income.
- food security – fish consumption in the Pacific Island region (derived mainly from coastal fisheries) is 3–5 times the global average, and fish supplies 50–90% of animal protein in the diets of coastal communities.

Effects of greenhouse gas (GHG) emissions

Continued GHG emissions at current rates are expected to cause rises in sea surface temperature, alterations in major ocean currents, reductions in the availability of nutrients underpinning the ocean's ecosystems and expansion of subsurface waters poor in oxygen. Carbon dioxide emissions, which make up 70% of GHGs, are acidifying the ocean (**Table 1**).

Preliminary modelling indicates that the projected changes to the tropical Pacific Ocean are likely to redistribute the abundant skipjack tuna to the central-eastern Pacific (**Figure 2**). Abundance of bigeye tuna is also expected to decrease in the western Pacific and increase in the east, whereas albacore are likely to shift poleward to avoid a projected increase in oxygen-poor waters in their present-day distribution. The response of yellowfin tuna has yet to be modelled. However, experiments show that survival and growth of their larvae may be affected by intense ocean acidification.

The quality of coral reefs as fish habitats will be degraded by ocean acidification (**Figure 3**) and more frequent coral bleaching due to increased sea surface temperature. Even under good management, coral cover is expected to decline from 40% to 15–30% by 2035 and 10–20% by 2050, leading to greater seaweed cover on reefs (**Table 1**).

The changes to the ocean and to coral reefs are expected to reduce catches of reef fish by 20% by 2050.

Implications

The effects on island economies of a decline in skipjack tuna catch in the western Pacific would be complex. There would be loss of fishing access fees and, although there are practical ways to supply the canneries in Papua New Guinea (PNG) with tuna from elsewhere in the region (see below), the viability of some canneries may depend on large catches continuing to be made in PNG's EEZ.

If the distribution of skipjack tuna shifts to the east as projected, the atoll nations in the central Pacific could benefit until 2050 – they could gain a higher proportion of fishing access fees and more business opportunities related to tuna. The islands furthest to the east (Cook Islands and French Polynesia) could benefit until 2100.

The projected declines in coral reef fisheries production would harm food security and livelihoods. In many Pacific Islands, rapid population growth and overfishing is widening the gap between the fish available from coral reefs and the fish needed for good nutrition. A decrease in the productivity of coral reef fisheries due to climate change and ocean acidification will increase this gap further.

To maintain livelihoods in the face of overfishing and coral degradation, more coastal fishing activities will need to be transferred from coral reefs to oceanic fisheries resources (**Figure 4**).

Table 1 Projected changes to the tropical Pacific Ocean and ecosystems supporting oceanic and coastal fisheries under a high (IPCC A2) emissions scenario in 2035, 2050 and 2100, relative to 1980–1999. Source: Bell et al. (2013). http://www.nature.com/nclimate/journal/v3/n6/full/nclimate1838.html

Feature	Year		
	2035	**2050**	**2100**
Ocean			
Currents	South Equatorial Current decreases; Equatorial Undercurrent becomes shallower; South Equatorial Counter Current decreases and retracts westward		
Sea surface temperature	+0.8°C	+1.2 °C	+2.5°C
Nutrient supply	Declines due to increased stratification		
Dissolved oxygen	Decreases due to lower oxygen intake at high latitudes		
Aragonite saturation (Ω)*	3.2-3.6	2.8-3.2	2.3-2.7
Change in pH (units)	-0.1	>0.1	-0.2 to -0.3
Sea-level rise (cm)	20-30	32-48	80-126
Oceanic food webs			
Pacific Equatorial upwelling	Area -20%, P 0%; Z -2%	Area -30%, P +2%; Z -3%	Area -50%, P +4%; Z -6%
Warm Pool	Area +20%, P -5%; Z -3%	Area +25%, P -9%; Z -9%	Area +50%, P -9%; Z -10%
Coral reef habitats			
Live coral cover (%)	-25 to -65	-50 to -70	>-90
Seaweed cover on reefs (%)	+40	+50	>+95

*Aragonite is a form of calcium carbonate and Ω is a measure of ocean acidification; P = net primary production; Z = zooplankton biomass

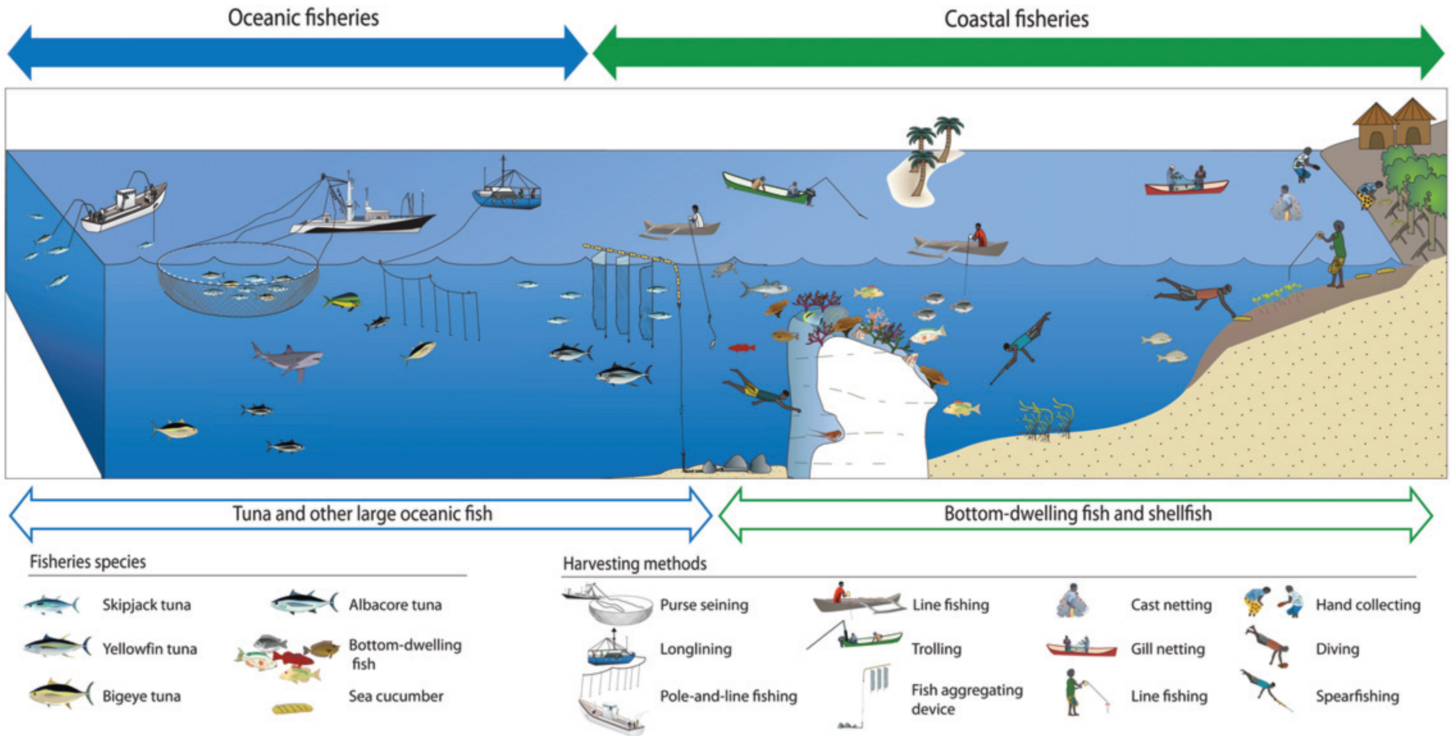

Figure 1. Oceanic and coastal fisheries of Pacific Island countries and territories.

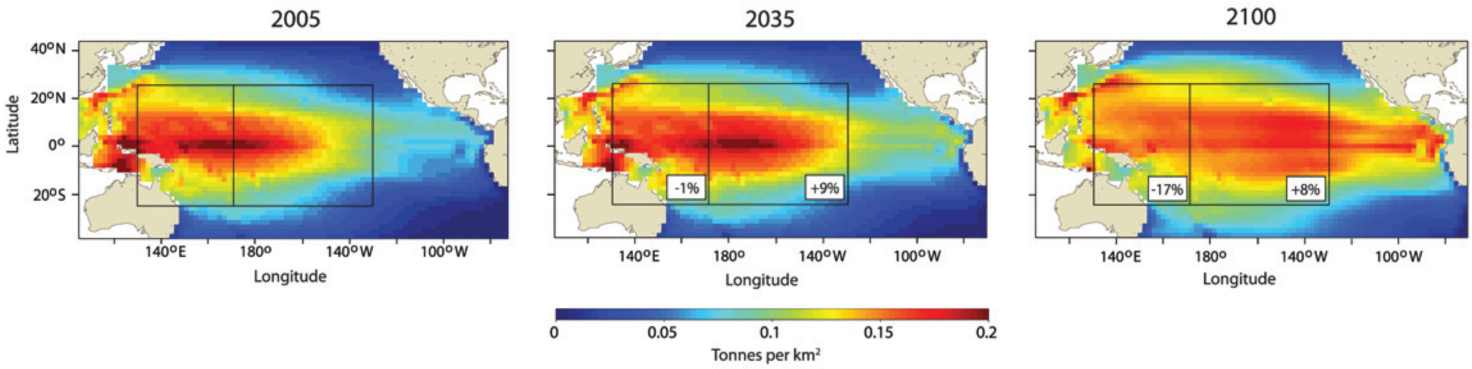

Figure 2. Projected distributions of skipjack tuna biomass across the tropical Pacific Ocean in 2035 and 2100 under the IPCC A2 high emissions scenario. Numbers are percentage changes for the outlined areas east and west of 170°E. Source: Lehodey et al. (2013). http://link.springer.com/article/10.1007/s10584-012-0595-1#page-1

Priority adaptations

Smart management can help reduce threats to the contributions of oceanic and coastal fisheries to Pacific Island economies and communities, and could also provide opportunities. The practical adaptations below can potentially sustain the supply of tuna to canneries in the west, harness the potential for increased earnings from tuna in the east, and reduce the dependence of Pacific Island communities on coral reef fisheries.

Develop and maintain economic partnership agreements with the European Union: The global sourcing provisions of these agreements can be used to continue the supply of tuna to canneries in PNG and Solomon Islands as tuna are redistributed further east.

Diversify sources of tuna for canneries: Requiring foreign vessels to land some tuna catch locally, and reducing access for foreign fleets to provide more fish for national vessels, will help countries secure the tuna supplies they need.

Full implementation of the vessel day scheme (VDS)[1] for managing tuna: Periodic adjustment of allocated vessel days within the VDS, based on recent catch history, will reduce the need for member countries in the central-eastern Pacific to purchase days from those in the west as redistribution of tuna occurs.

Develop service industries for industrial fishing vessels and fish cargo vessels: Changes in the location and frequency of trans-shipping should provide opportunities to boost the economies of the smaller island countries in the central-eastern Pacific.

Energy efficiency programmes for industrial fleets: Reducing fuel use should help fleets cope with rises in oil prices in the shorter term and lower the costs for national fleets fishing further afield as tuna distributions change.

Increase access to tuna and bycatch for food security: Distributing small tuna and bycatch during trans-shipping operations in major ports can supply more fish for urban populations. Installing nearshore, anchored fish aggregating devices (FADs) (**Figure 4**) will give coastal communities and their growing populations easier access to fish as coral reef fisheries decline.

[1] The VDS is operated by the Parties to the Nauru Agreement, see http://www.pnatuna.com

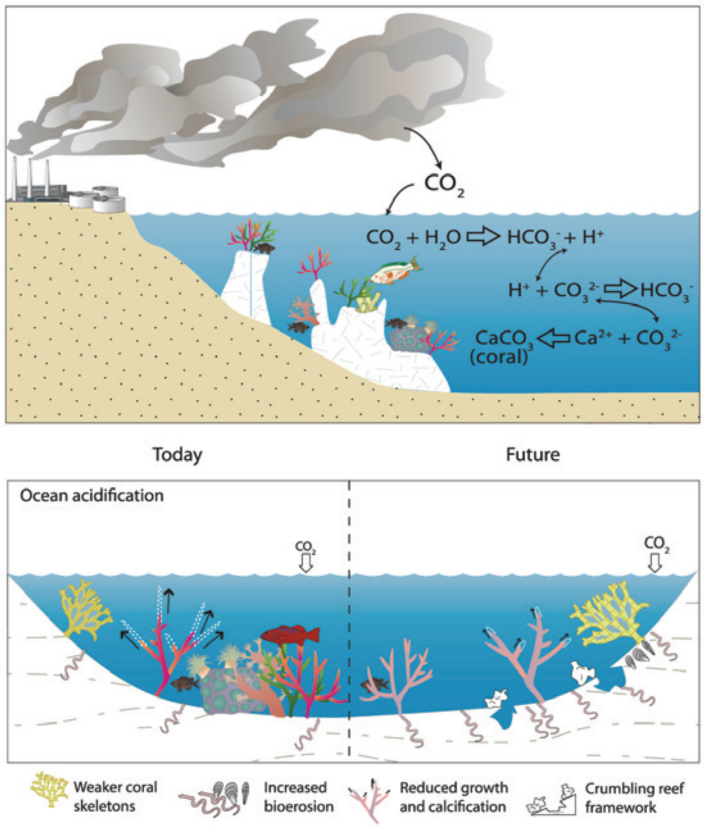

Figure 3. Continued carbon dioxide (CO_2) emissions are acidifying the ocean and decreasing carbonate ions available for corals to construct reefs (top panel). When atmospheric CO_2 exceeds 450 ppm, net erosion of coral reefs is expected to occur (bottom panel). Source: Hoegh-Guldberg et al. (2011). http://cdn.spc.int/climate-change/fisheries/assessment/chapters/5-Chapter5.pdf

Suggested policy actions

There are a number of feasible policy actions to support these adaptations, including the following:

- Incorporate the implications of climate change in the management objectives of the Western and Central Pacific Fisheries Commission.
- Require all industrial tuna vessels to provide operational-level catch and effort data to help improve models for projecting the redistribution of tuna stocks.
- Strengthen national capacity to administer the VDS.
- Adjust national tuna management plans and marketing strategies to create more flexible arrangements for buying and selling tuna.
- Use licence conditions to ensure local canneries get the quantities of tuna needed to operate efficiently.
- Specify the location and frequency of trans-shipping operations to reduce variation in fish supply to urban areas.
- Minimize the effects of industrial tuna fleets on the catch of small-scale tuna fishers by adjusting the boundaries of fishing exclusion zones.
- Include nearshore FADs as part of the national infrastructure for food security and replace FADs promptly when they are lost.
- Enforce careful catchment management by the agriculture, forestry and mining sectors to prevent sedimentation and pollution and reduce stresses on coral reefs, mangroves and seagrasses, and the coastal fisheries they support.
- Promote community-based fisheries management to reduce overfishing and optimize coastal fisheries production.
- Support the monitoring systems needed to measure changes in the productivity of coastal fisheries, and the relative effects of climate change and ocean acidification, coastal zone development and overfishing, on coastal fisheries resources.

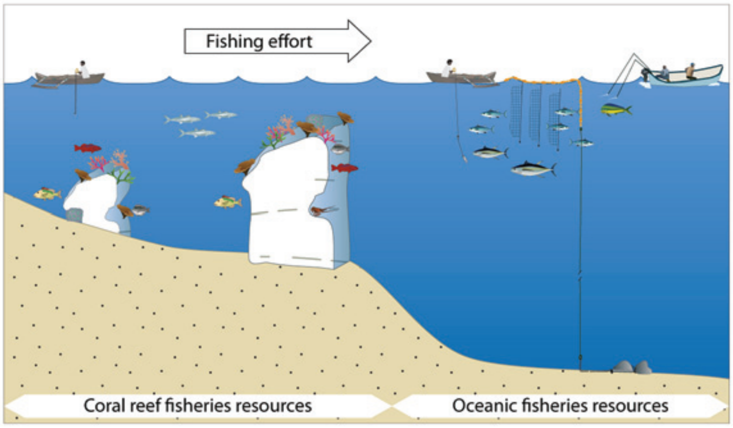

Figure 4. A key adaptation for coastal fisheries – equip and train small-scale fishers to transfer some of their effort from coral reef fisheries to oceanic fisheries resources by using nearshore fish aggregating devices.

Further reading

Bell JD, Johnson JE and Hobday AJ (eds) (2011) Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change. Secretariat of the Pacific Community, Noumea, New Caledonia. http://www2008.spc.int/index.php?option=com_content&view=article&id=969:climate-book&catid=257

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SPC (2013) Status Report: Pacific Islands Reef and Nearshore Fisheries and Aquaculture. Secretariat of the Pacific Community, Noumea, New Caledonia. http://www.spc.int/DigitalLibrary/Doc/FAME/Reports/Anon_13_Status_Report.pdf

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