



Freshwater fisheries and climate change



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Purpose

The aim of this policy brief is to:

- alert Pacific Island countries and territories (PICTs) to the projected effects of climate change on the contributions that freshwater (and estuarine) fisheries make to food security; and
- identify the adaptations and policies needed to reduce the threats and capitalise on the opportunities.

Key messages

Projected increases in air temperatures and rainfall in the tropics are expected to improve the quality and area of habitats for freshwater fish. With good management of catchments, these changes have potential to increase the availability of animal protein in the diets of rural communities living near rivers and lakes. Projected decreases in rainfall in the subtropics are likely to reduce freshwater fish production.

Significance of freshwater fisheries

Catches of freshwater fish make up around 4% of gross domestic product (GDP) derived from all fishing activities in the tropical Pacific. This contribution is remarkable considering that freshwater (and estuarine) fish habitats (Figure 1) make up such a small proportion of the land area of PICTs. Production of freshwater fish from the region is estimated to be about 24,000 tonnes per year, with most of the catch coming from Papua New Guinea (PNG) and other countries in Melanesia (Table 1). Most freshwater fish is used for subsistence – some riverside communities eat as much fish as people who live on the coast (where fish provides 50-90% of dietary animal protein).

Table 1 Estimated annual freshwater fisheries catches from Pacific Island countries and territories (PICTs). Source: Gehrke et al. (2011) Chapter 10. PDF <http://www.spc.int/climate-change/fisheries/assessment/main-book.html>

PICT	Catch (tonnes)
Melanesia	
Fiji	4146
New Caledonia	10
PNG	17,500
Solomon Islands	2000
Vanuatu	80
Micronesia	
FSM	1
Guam	3
Palau	1
Polynesia	
American Samoa	1
Cook Islands	5
French Polynesia	100
Samoa	10
Tonga	1
Total	23,858

Projected effects of climate change on freshwater fish habitats

Higher rainfall in the tropics (Table 2) is expected to enhance the quality and quantity of freshwater fish habitats by improving river flows and the connectivity between river channels and floodplains (Table 3). Warmer temperatures are likely to make some shallow habitats unsuitable for fish but should also promote the growth of the aquatic vegetation that provides habitats for fish. In the subtropics, the projected decreases in rainfall and the possibility of more intense cyclones are likely to reduce the extent of freshwater fish habitat. As sea level rises (Table 2), estuarine fish habitats will penetrate further inland.

Projected effects of climate change on freshwater fish

Where catchment vegetation is in good condition, freshwater (and estuarine) fisheries in tropical areas are expected to be favoured by the direct and indirect effects of climate change (Table 3). The greatest benefits are likely to come from increases in river flow, which improve fish habitats, provide cues for fish migration, and enhance reproduction and recruitment of fish. Changes in catches in subtropical areas are expected to be small or negative.

Implications for food security

Provided catchment vegetation is maintained (Figure 2), and freshwater fish habitats are well managed and allowed to expand with increasing rainfall, freshwater fisheries have potential to provide inland communities with more food. Much of the increased production will come from introduced and invasive fish species already present in the region. Plans are needed to make the best use of such species.

Table 2 Projected changes to the main features of surface climate and sea level expected to affect freshwater (and estuarine) fish habitats under a high (IPCC A2) emissions scenario in 2035, 2050 and 2100, relative to 1980–1999. Source: Lough et al. (2011) Chapter 2. PDF <http://www.spc.int/climate-change/fisheries/assessment/main-book.html>; Ganachaud et al. (2011) Chapter 3. PDF <http://www.spc.int/climate-change/fisheries/assessment/main-book.html>

Climate feature	2035	2050	2100
Air temperature	+0.5 to 1.0°C	+1.5°C	+2.5 to +3.0°C
Rainfall			
- tropical	+5 to 20%	+10 to 20%	+10 to 20%
- subtropical	-5 to 20%	-5 to 20%	-5 to 20%
Cyclones	Number of cyclones may decrease but they may be more intense		
Sea-level rise			
- IPCC	+8 cm	+18 to 38 cm	+23 to 51 cm
- Other models	+20 to 30 cm	+70 to 100 cm	+90 to 140 cm

Adaptations

The following management measures should help reduce the threats to freshwater (and estuarine) fisheries and also help capitalise on the opportunities created by increased river flows.

Manage and restore vegetation in catchments: Increasing the vegetation in catchments will help reduce the transfer of sediments and nutrients into rivers and lakes after heavy rain. Better vegetation cover will also help limit increases in water temperatures through shading.

Allow for expansion of freshwater habitats: Providing opportunities for river channels to migrate naturally after floods prevents permanent loss of these important freshwater habitats. Ensuring that inundation of undeveloped floodplains is not constrained will create additional fish habitat. Removing or modifying man-made barriers that prevent freshwater fish from retreating upstream as salt water penetrates into rivers with rising sea levels will help maintain stocks of these species.

Manage freshwater fisheries to harness new opportunities: Harvesting more freshwater fish as river flows and water temperatures increase will depend on (1) fishing for a wider range of species and in new areas of habitat; (2) managing invasive species favoured by climate change to reduce negative interactions with more valuable fish; and (3) strengthening rights to the use of freshwater habitats to conserve the benefits for resident communities.

Improve post-harvest methods: Training communities, particularly women, in improved methods for smoking, salting and drying fish will extend the shelf life of catches when fish are seasonally abundant.



Suggested supporting policy actions

- Strengthen governance for sustainable use of freshwater (and estuarine) fish habitats by building the capacity of management agencies to understand the likely effects of climate change and empowering communities to manage fish habitats.
- Promote ecosystem-based management measures for agriculture, forestry and mining to prevent damage to fish habitats through soil loss, transport of sediments and nutrients into watercourses, and pollution.
- Minimise barriers to landward expansion of freshwater fish habitats during development of climate change adaptation strategies for other sectors.
- Apply 'primary fisheries management' to freshwater (and estuarine) fish stocks to maintain their potential to make greater contributions to food security as their productivity increases with climate change.
- Revise primary school curricula to teach children about freshwater (and estuarine) fish and food security, focusing on the importance of fish for their health; the basic management actions needed to maintain fish habitats and fish stocks; and the options for increasing future supplies of fish.

Figure 1 Range of freshwater (and estuarine) fisheries in the tropical Pacific and the habitats that support them.

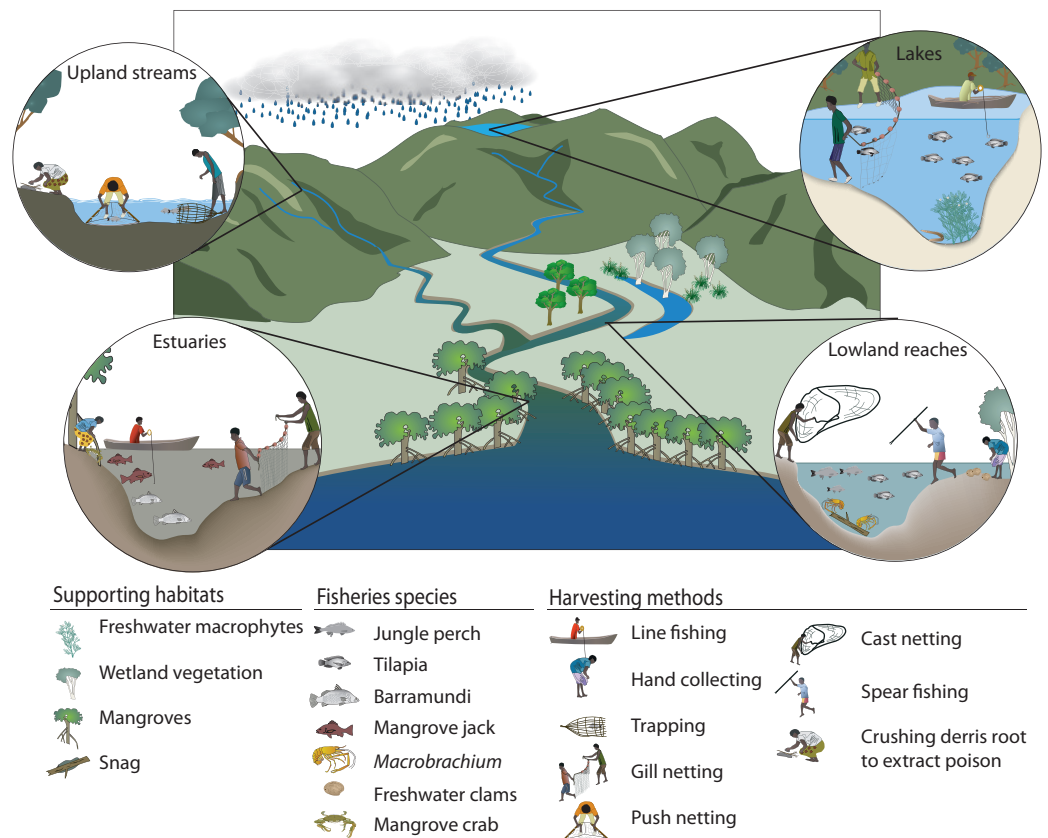


Table 3 Projected changes in freshwater fish habitat, and freshwater fish catch from well-managed catchments, in the tropical Pacific under a high (IPCC A2) emissions scenario in 2035, 2050 and 2100, relative to 1980–1999. Note that decreases in fish habitat (negative values) are expected to occur in the subtropics. Source: Gehrke et al. (2011) Chapters 7 and 10. PDF <http://www.spc.int/climate-change/fisheries/assessment/main-book.html>

	2035	2050	2100
Change in habitat area (%)	-5 to +10	-10 to +10	-20 to +20
Change in catch (%)	0 to +2.5	0 to +7.5	0 to +12.5

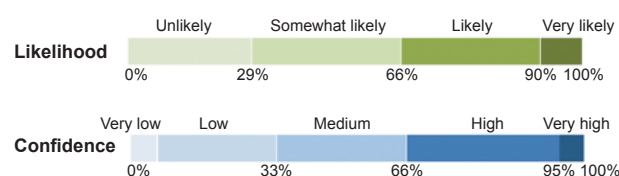
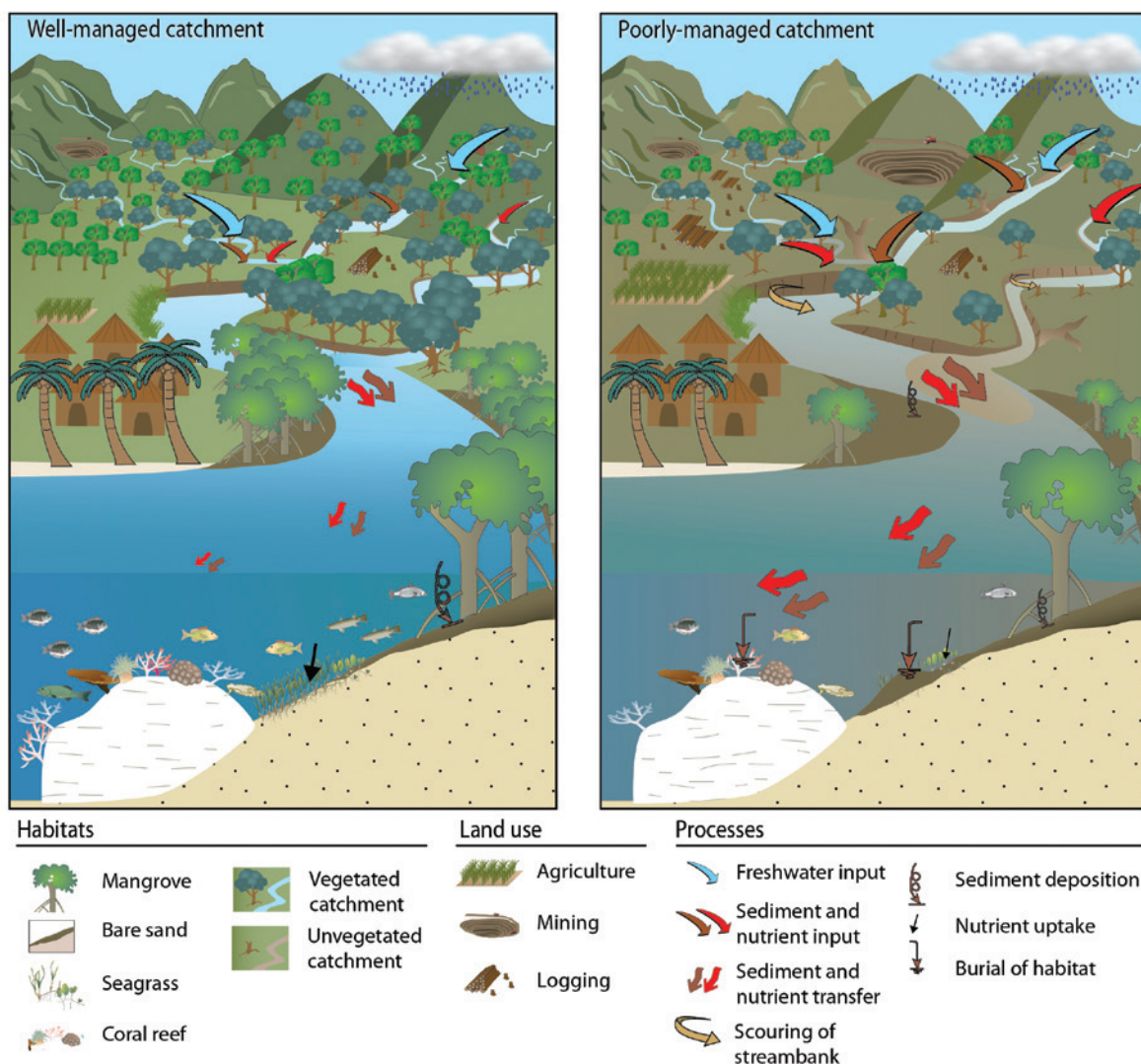


Figure 2 Differences in the quality of fish habitats in well-managed and poorly-managed catchments



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 (see Chapters 7, 10, 12 and 13).

Gillett R (2009) Fisheries in the Economies of Pacific Island Countries and Territories. Asian Development Bank, Manila, Philippines.

Gillett R and Cartwright I (2010) The Future of Pacific Island Fisheries. Secretariat of the Pacific Community, Noumea, New Caledonia.

SPC (2008) Fish and Food Security. SPC Policy Brief 1/2008. Secretariat of the Pacific Community, Noumea, New Caledonia.

Technical assistance

For advice on the status and management of freshwater fisheries in the tropical Pacific, contact SPC's Fisheries, Aquaculture and Marine Ecosystems Division (cfpinfo@spc.int).



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