POLICY BRIEF
16/2012
Secretariat of the Pacific Community

Coastal fisheries and climate change

Photo: Jack Fields/Corbis

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 coastal fisheries make to food security and livelihoods; and
- identify the adaptations and policies needed to reduce the threats and capitalise on the opportunities.

Key messages

Projected declines in coastal fisheries production due to the effects of climate change are expected to reduce the availability of food and livelihood opportunities for coastal communities. Several practical adaptations can minimise these effects and provide access to alternative supplies of fish for food security and jobs.

Significance of coastal fisheries

Subsistence fishing provides 50-90% of animal protein in the diet of coastal communities in many PICTs (Table 1). Almost half of households in representative coastal communities also earn their first or second income from catching or selling fish. Bottom-dwelling coastal fish and shellfish provide most of these benefits.

Projected effects of climate change on coastal fish habitats

Warmer air and sea surface temperatures, ocean acidification, rising sea levels and higher rainfall (Table 2) are expected to cause significant losses of the coral reef, mangrove, seagrass and intertidal habitats that provide shelter and food for coastal fish and shellfish (Table 3).

Projected effects of climate change on coastal fish and shellfish

The direct effects of warmer water temperatures, changes in ocean currents, reductions in nutrient supply and ocean acidification on the reproduction, growth and distribution of coastal bottom-dwelling fish and shellfish, and the loss of habitats described above, are expected to cause progressive reductions in the productivity of coastal fisheries (Table 4).

Implications for food security and livelihoods

In many PICTs, rapid population growth already means that the catches of fish and shellfish from coral reefs and other coastal habitats will not be able to supply the 35 kg of fish per person per year recommended for good nutrition. Projected decreases in production of bottom-dwelling fish and shellfish will increase the gap between the quantities of fish and shellfish available and the amount required for food security (Table 5). The number of livelihoods that can be supported by bottom-dwelling fish and shellfish is also likely to decrease.

Adaptations

The following management measures should help reduce the threats to the food security and livelihood benefits derived from coastal fisheries. They should also help communities capitalise on the opportunities to make greater harvests from the projected increases of tuna in the coastal waters of some PICTs.

Manage and restore vegetation in catchments: Increasing the vegetation in catchments will reduce transfer of sediments and nutrients to coasts after heavy rain and help prevent damage to the coral reefs, mangroves and seagrasses supporting coastal fisheries.

Foster the care of coastal fish habitats: Preventing pollution and managing waste in coastal areas, and eliminating damage to coral reefs, mangroves and seagrasses (e.g. by destructive fishing methods, gathering building materials; and careless tourist activities), will help build resilience of coastal fish habitats to climate change.

Provide for landward migration of coastal fish habitats: Prohibiting construction of buildings adjacent to mangroves, seagrasses and intertidal flats, and installing wide culverts beneath existing roads, will allow water to reach low-lying areas and extend these fish habitats as sea level rises.

Sustain production of bottom-dwelling fish and shellfish: Using community-based ecosystem approaches to fisheries management to maintain the replenishment potential of stocks will help reduce the gap between coastal fisheries production and the fish needed by rapidly growing populations.

Diversify catches of bottom-dwelling fish and shellfish: Catching fish and shellfish in proportion to there altered abundance under climate change will help optimise the potential production from coastal fisheries.

Increase access to tuna for coastal communities: Installing fish aggregating devices (FADs) (Figure 1) close to the coast to attract tuna and other pelagic fish species will provide better access to fish as human populations increase and bottom-dwelling fish and shellfish decline. Providing training in the methods needed to fish around FADs will optimise such investments.

Develop coastal fisheries for small pelagic species: Increasing the catch of mackerel, anchovies, pilchards, sardines, scads and fusiliers will improve access to fish for food security and livelihoods.

Improve post-harvest methods: Training communities, particularly women, in appropriate ways to improve traditional smoking, salting and drying methods will extend the shelf life of fish when good catches are made.

Table 1 Importance of coastal fisheries to Pacific Island countries and territories (PICTs) in terms of subsistence and commercial catch, contributions to food security and household income. Source: Bell et al. (2011) Chapter 12 PDF: http://www.spc.int/climate-change/fisheries/assessment/main-book.html

PICT	Subsistence catch (tonnes)	Commercial catch (tonnes)	Fish eaten per person (kg per year)*	Animal protein in diet (%)	Households earning 1st/2nd income (%)[a]
Melanesia					
Fiji	17,400	9500	113		93.3
New Caledonia	3500	1350	43		46.2
PNG	30,000	5700	53		85.8
Solomon Islands	15,000	3250	118	94	61.0
Vanuatu	2830	538	30	60	61.1
Micronesia					
FSM	9800	2800	96	80	52.5
Guam	70	44			
Kiribati	13,700	7000	115	89	58.1
Marshall Islands	2800	950			53.6
Nauru	450	200	62	71	22.0
CNMI	220	231			
Palau	1250	865	79	59	25.9
Polynesia					
American Samoa	120	35			
Cook Islands	267	133	79	51	20.1
French Polynesia	2880	4002	61	71	26.7
Niue	140	10	50		10.1
Pitcairn Islands	7	5			
Samoa	4495	4129	94		50.8
Tokelau	375	0			
Tonga	2800	3700	85		46.2
Tuvalu	989	226	146	77	48.4
Wallis and Futuna	840	121	56		44.3
Total	**109,933***	**44,789***			**(47.4)**

*Includes 25-30% nearshore pelagic fish, including tuna; a = based on estimates from at least four sites in each PICT; blank spaces indicate that no estimate is available

Table 2 Projected changes to the main features of surface climate and the tropical Pacific Ocean expected to affect coastal fish habitats, and bottom-dwelling fish and shellfish, 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

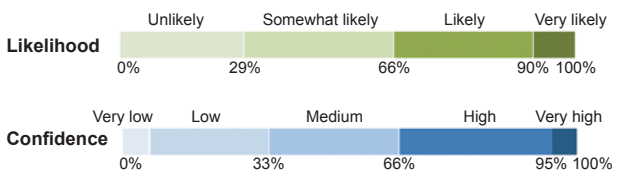
Climate feature	2035	2050	2100
Air temperature	+0.5 to 1.0°C	+1.5°C	+2.5 to +3.0°C
Rainfall - tropical	+5 to 20%	+10 to 20%	+10 to 20%
- subtropical	-5 to 20%	-5 to 20%	-5 to 20%
Cyclones	Number of cyclones may decrease but they may be more intense		
Sea surface temperature	+0.7 to +0.8°C	+1.2 to +1.6°C	+2.2 to +2.7°C
Currents	South Equatorial Current decreases at the equator; Equatorial Undercurrent becomes shallower; South Equatorial Counter Current decreases and retracts westward in the upper 50 m		
Nutrient supply	Decrease due to increased stratification and shallower mixed layer, with a possible decrease of up to 20% by 2100		
Aragonite saturation (Ω)*	Ω ~ 3.3	Ω ~ 3.0	Ω ~ 2.4
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

*A measure of ocean acidification

Table 3 Projected losses of coral reef, mangrove and seagrass habitats in the tropical Pacific under a high (IPCC A2) emissions scenario in 2035, 2050 and 2100, relative to 1980–1999. Source: Hoegh-Guldberg et al. (2011). Chapter 5 PDF: http://www.spc.int/climate-change/fisheries/assessment/main-book.html; Waycott et al. (2011) Chapter 6 PDF: http://www.spc.int/climate-change/fisheries/assessment/main-book.html

Habitat	Type of change	Year	Change (%)
Coral reef	Live coral cover	2035	-25 to -65*
		2050	-50 to -70*
		2100	>-90*
Mangrove	Area	2035	-10 to -30
		2050	-50 to -70
		2100	-60 to -80
Seagrass	Area	2035	-5 to -20
		2050	-5 to -35
		2100	-10 to -50

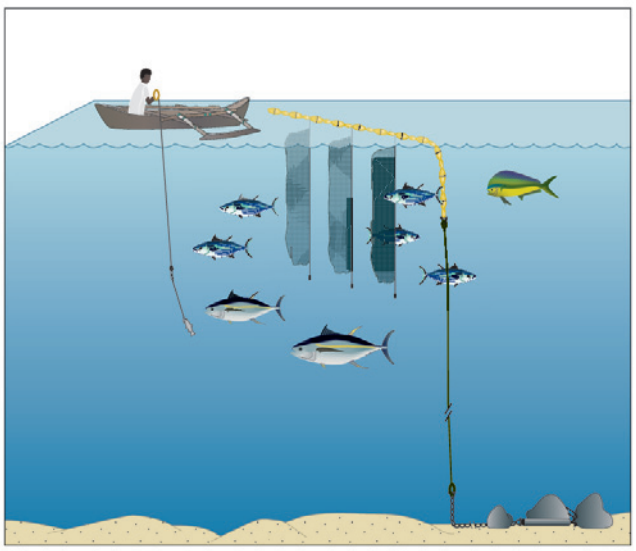
*Based on strong management of coral reefs to minimise the effects of local stressors



Suggested supporting policy actions

- Strengthen governance for sustainable use of all coastal fish habitats by: (1) building the capacity of management agencies to understand the threats posed by climate change; (2) empowering communities to manage fish habitats; and (3) changing agriculture, forestry and mining practices to prevent sedimentation and pollution.
- Protect source and resilient coral reefs supplying recruits to fish populations on 'downstream' reefs to help stocks on such source reefs recover after coral bleaching or cyclones.
- Minimise barriers to landward migration of coastal habitats during development of strategies to assist other sectors to respond to climate change.
- Promote mangrove replanting programmes in suitable areas to meet the twin objectives of enhancing habitat for coastal fisheries and capturing carbon.
- Apply 'primary fisheries management' to stocks of coastal fish and shellfish to maintain their potential for replenishment.
- Restrict export of coastal bottom-dwelling fish to ensure that these resources are available for national food security where necessary (does not apply to deepwater snappers).
- Increase access to tuna for the food security of coastal communities where required by reducing national allocations to industrial fleets.

Figure 1 Anchored fish aggregating device (FAD) suitable for placing in coastal waters (usually 300–1000 m deep) to increase access to tuna and other pelagic fish species.



Suggested supporting policies *cont'd*

- Include anchored inshore FADs as part of the national infrastructure for food security, and make provision for regular maintenance and replacement of FADs.
- Provide training and technical support for coastal fishing communities to catch small pelagic fish.
- Revise primary school curricula to teach children about fish and food security, focusing on the importance of fish for their health; the basic management actions needed to maintain coastal fish habitats and fish stocks; and the options for increasing future supplies of fish.

Table 4 Projected change (%) in production of bottom-dwelling fish and shellfish comprising coastal fisheries in the tropical Pacific under a high (IPCC A2) emissions scenario in 2035, 2050 and 2100, relative to 1980–1999. Source: Pratchett et al. (2011) Chapter 9 PDF: http://www.spc.int/climate-change/fisheries/assessment/main-book.html

Year	Bottom-dwelling fish	Shellfish for export*	Shellfish for subsistence
2035	-2 to -5	-2 to -5	Nil
2050	-20	-10	-5
2100	-20 to -50	-20	-10

*Mainly sea cucumbers and trochus

Table 5 Expected production of bottom-dwelling fish and shellfish (kg per person per year) in 2035, 2050 and 2100 due to effects of population growth (P) and added effects of climate change (CC) under a high (IPCC A2) emissions scenario for selected Pacific Island countries and territories (PICTs). Information for 2010 shows PICTs where coral reefs are presently unable to provide the recommended 35 kg of fish per person per year (based on estimated sustainable production of 3 tonnes of fish per km^2 of reef per year). Source: Bell et al. (2011) Chapter 12 PDF: http://www.spc.int/climate-change/fisheries/assessment/main-book.html

PICT	2010	2035		2050		2100	
		P	CC	P	CC	P	CC
American Samoa	17	13	12	11	10	8	6
Fiji	40	35	34	32	28	26	20
Guam	4	3	3	3	2	2	2
Nauru	2	1	1	1	1	1	1
CNMI	12	10	10	9	8	9	6
PNG	12	8	8	6	6	4	3
Samoa	33	30	29	29	25	25	19
Solomon Islands	50	28	28	23	19	14	11
Vanuatu	16	10	9	8	7	6	4

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 (Chapters 2, 3, 5, 6, 9, 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.

SPC (2012) Fish Aggregating Devices (FADs). SPC Policy Brief 19/2012. Secretariat of the Pacific Community, Noumea, New Caledonia.

Technical assistance

For advice on the status and management of coastal fisheries in the tropical Pacific contact SPC's Coastal Fisheries Programme (cfpinfo@spc.int).

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