Initial recommended policy actions

- Plan to diversify the national infrastructure for food security, including measures such as:
  - installing and maintaining national networks of low-cost inshore FADs for subsistence fishers;
  - developing hatcheries to supply juvenile fish for small-pond aquaculture; and
  - establishing infrastructure to store and distribute tuna landed by industrial fleets in urban centres to supply low-cost fish for rapidly growing populations.
- Strengthen initiatives to reduce existing stresses on coastal fisheries (overfishing and degradation of fish habitats due to careless land use in catchments) to maximise the natural potential of these resources to adapt to climate change.
- Raise awareness among industry and communities of the changing environmental conditions and the need to diversify how and where they fish and, in the case of rural communities, how to produce and store other foods.
- Establish monitoring programmes to assess the success of management methods aimed at adapting to climate change.

Technical assistance

For assistance with ways of diversifying fish production, including installation of FADs and establishment of small-pond aquaculture, contact the SPC Coastal Fisheries Programme (cfpinfo@spc.int).

Further reading

- The future of Pacific fisheries – planning and managing for economic growth, food security and sustainable livelihoods. 5th SPC Conference, paper no. 4. (available from SPC on request).
- Bell et al. 2008. Planning the use of fish for food security in the Pacific. Marine Policy doi:10.1016/j.marpol.2008.04.002.
- FAO. 2007. Building adaptive capacity to climate change. Policies to sustain livelihoods and fisheries. New directions in fisheries – A series of policy briefs on development issues. No. 8. (http://www.sflp.org/briefs/eng/policybriefs.html).
- Hoegh-Guldberg et al. 2007. Coral reefs under rapid climate change and ocean acidification. Science Vol. 318, pp. 1737-1742.
- Munday et al. 2008. Climate change and the future of coral reef fishes. Fish and Fisheries Vol. 9, pp. 261-285.

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Prepared in collaboration with members of the Technical Working Group for the project to assess the impact of climate change on fisheries and aquaculture in the Pacific.

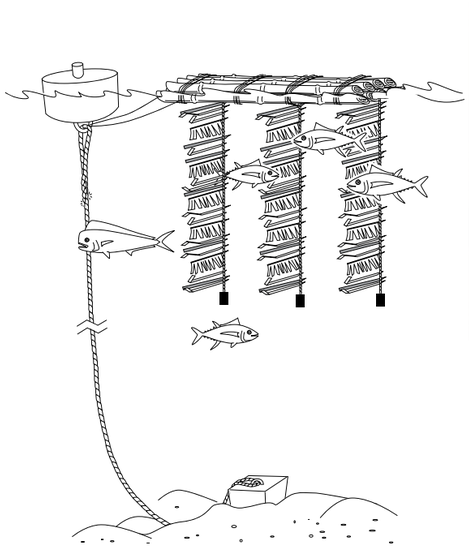

FIGURE 6. Design of low-cost inshore fish aggregating devices (FADs), with tuna caught around FADs at Rakahanga Atoll, Cook Islands. Photos courtesy of Cook Islands Ministry of Marine Resources.

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Fisheries and climate change

Purpose

The aim of this brief is to:

- alert governments to some of the risks that climate change poses to the fisheries priorities of the Pacific Plan and the actions identified in the Vava'u Declaration on Pacific Fisheries Resources; and
- identify how the fishing industry and fishing communities can begin to adapt to changing environments to help maintain the benefits of fisheries.

This is the first in a series of interim Policy Briefs on this issue. As more knowledge is gained through the new project on fisheries and climate in the region[1], more comprehensive recommendations for adaptive management will be provided.

Key messages

- Ecosystems that support fisheries in the Pacific are expected to change – favourable oceanic conditions for skipjack tuna are projected to shift further east, and there is a serious risk that coral reefs will be degraded by warmer and more acidic oceans.
  - Changes in the distribution and abundance of tuna have implications for the long-term profitability of industrial fisheries and canneries in the western Pacific.
  - Degraded coral reefs will support fewer species of fish, and different types of fish, with possible consequences for the food security and livelihoods of Pacific island people.
- Storms of increasing intensity are likely to damage fishing and aquaculture infrastructure more frequently, and increase the risks and costs of fishing at sea.
- To maintain the important contribution of fish to food security in the face of climate change, the production, processing and distribution of fish must be diversified.
- Governments can reduce the effects of climate change on coastal fisheries by helping communities improve the way they manage fish habitats and local fish stocks.

Significance of fisheries to the Pacific

Fish and fishing are fundamental to life in the Pacific; everywhere in the region, they contribute substantially to subsistence, market-based economies and cultures. In a region blessed with abundant tuna and a long tradition of relying on fish for food, but with limited opportunities to earn income, national plans for the sustainable use of fish must address three critical questions: How can tuna best contribute to economic growth? How much fish will be needed for future food security? How many livelihoods can be based on sustainable use of fisheries resources?

Pacific leaders have called for a long-term strategic approach to Pacific fisheries[2]. This approach must centre on:

- assessing sustainable levels of production from oceanic, coastal and freshwater fisheries, and aquaculture;
- harmonising the use of this production to optimise economic growth, food security and livelihoods; and
- implementing policies and management that ensure effective operation of the best vehicles for providing sustainable supplies of fish (see Figure1).

Tuna fishing boats (*Bonitiers*) damaged by a cyclone in French Polynesia © IRD, Francois Solter

1 With assistance from AusAID, the Secretariat of the Pacific Community is now co-ordinating a major project to assess the impact of climate change on fisheries and aquaculture in the Pacific. See SPC New Project Brief.

2 Documented in the Vava'u Declaration on Pacific Fisheries Resources, reiterated at the Special Theme of the 5th Pacific Conference on the 'Future of Pacific Fisheries', and discussed further at the 4th Annual Forum Fisheries Committee Ministerial Meeting

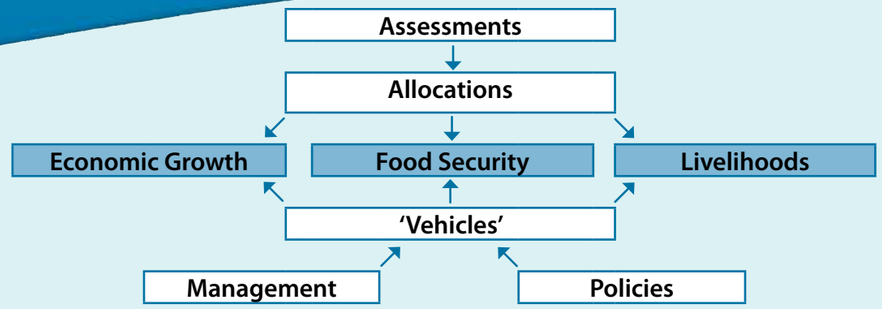


FIGURE 1. Key components of a strategic approach to using oceanic, coastal and freshwater fisheries, and aquaculture, to meet national needs for food and aspirations for economic growth and livelihoods.

Effects of climate change

National plans to optimise benefits from fisheries could be derailed by climate change. These plans, and the actions for implementing them, must be adapted to changing environmental conditions so that they succeed in the long term.

The key threats to Pacific fisheries and aquaculture from climate change include:

Changes to the distribution and abundance of tuna. Alterations to water temperatures and currents (see Figure 2), and the food chains that support tuna, are projected to affect the location and abundance of tuna species. Preliminary models indicate that the concentrations of skipjack tuna, for example, are likely to be located further to the east than in the past (see Figure 3). This has implications for the long-term development and profitability of national industrial fishing fleets and canneries in the western Pacific.

Decline in coral reefs and coastal fisheries. Rising sea surface temperatures and the consequences of more acidic oceans (see Figure 4) are projected to have direct impacts on the growth of hard corals and the complex fish habitats they create. Degraded coral reefs (see Figure 5) are likely to support different types of fish and perhaps lower yields. Reduced catches of reef fish will widen the expected gap between the fish available and the fish needed for food security[3].

Damage to infrastructure. Storms of greater intensity are predicted, which will increase the risk of damage to wharfs and essential infrastructure. There may also be higher financial risks associated with coastal aquaculture due to more frequent damage to equipment.

Greater costs for fishing at sea. Fleets will need to be upgraded to increase the safety of fishing operations as more severe storms occur. When these costs are combined with loss of days at sea due to bad weather, and higher fuel costs, the profitability of national enterprises could be jeopardised.

Difficulties in developing freshwater aquaculture. Changing patterns of rainfall and more intense storms are likely to flood aquaculture ponds more regularly in some places, and make small-pond farming impractical in others due to more frequent droughts.

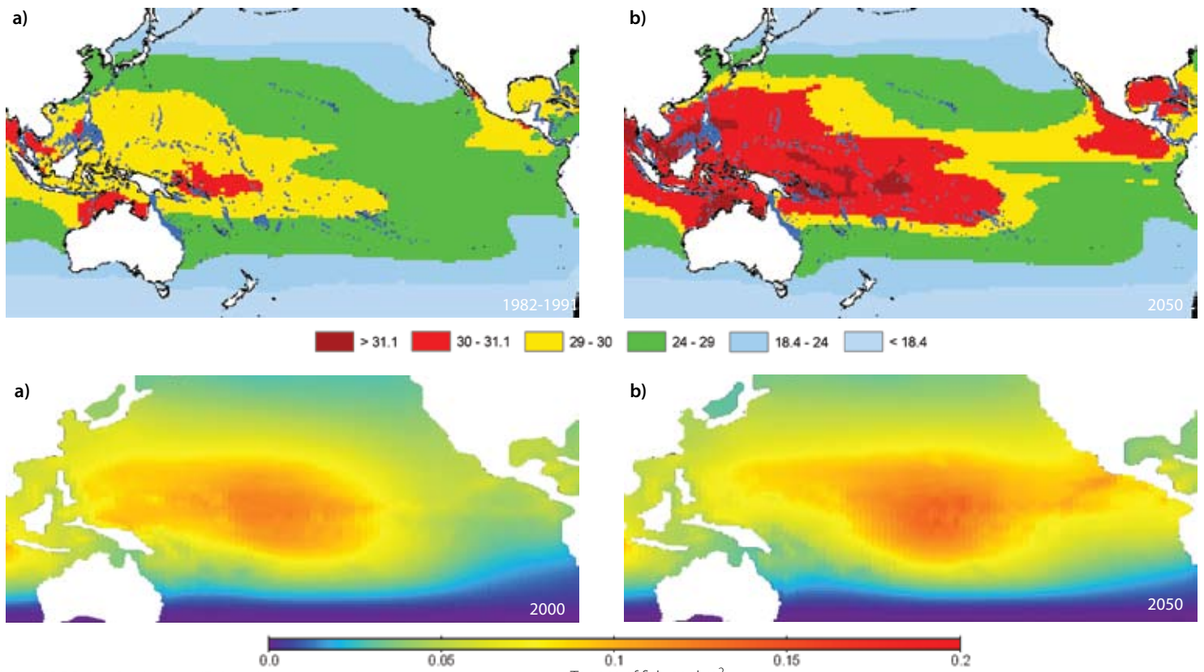


FIGURE 2. a) Maximum monthly Pacific sea surface temperatures 1982-1991; b) projected sea surface temperatures by 2050; derived from Guinotte et al. (2003) Coral Reefs Vol. 22, pp. 551-558. Reproduced with permission of the author.

FIGURE 3. a) Estimated distribution and abundance of skipjack tuna in the Pacific in 2000; and b) preliminary modeling of skipjack tuna distribution in 2050; based on the study 'Forecasts of population trends for two species of tuna under an IPCC scenario' presented by Lehodey et al. at the international symposium "Effects of Climate Change on World's Oceans", Gijon, Spain, 19-23 May 2008. Reproduced with permission of the author.

3 See SPC Policy Brief 1/2008 'Fish and food security'.

FIGURE 4. Availability (supersaturation levels) of the carbonate mineral, aragonite, needed by corals to build their skeletons and form structurally complex reefs; a) calculated pre-industrial aragonite levels c. 1870, CO_2 = 280 ppm; b) projected aragonite levels in 2050, CO_2 = 465 ppm. Maps based on information in Guinotte et al. (2003) Coral Reefs Vol. 22, pp. 551-558, and reproduced with permission of the author. Note that increasing atmospheric CO_2 results in more acidic oceans, which in turn blocks the availability of aragonite.

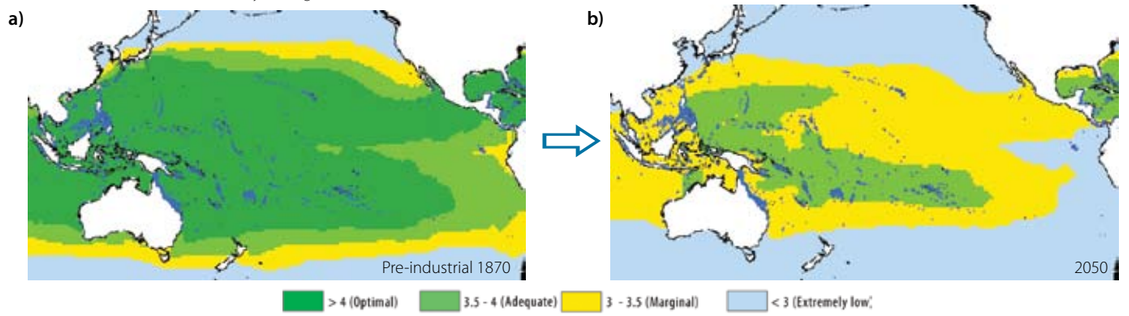
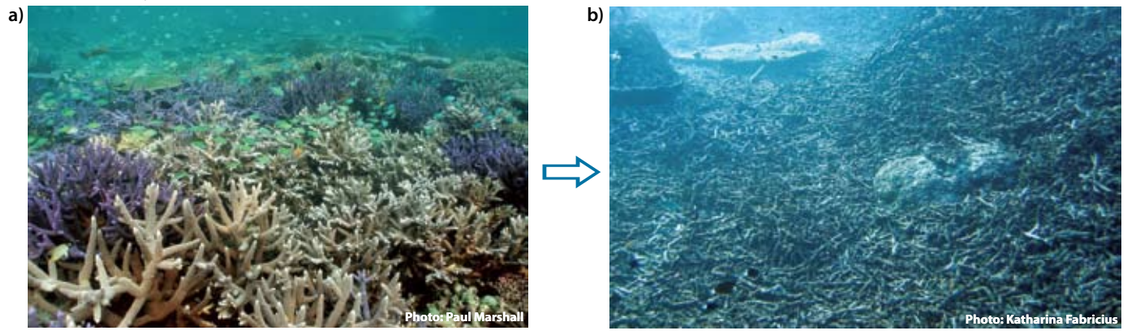


FIGURE 5. a) Present-day healthy coral reef, b) a reef badly damaged by a cyclone, showing what reefs may look like when corals do not have enough aragonite to construct complex skeletons.



Adaptations required

Although rural communities in the Pacific have a history of overcoming the effects of natural disasters and resulting food shortages, new levels of awareness and adaptation are needed to address the projected threats to fisheries.

Governments and NGOs must alert fishing industries and fishing communities to the likelihood of unexpected environmental conditions and help them build on their natural resilience to make the adaptations needed to handle the uncertainty of climate change. In particular, they need to diversify the ways they produce, process and distribute fish. Fishers will then be able to switch more easily to those methods and areas least affected, or favoured, by the changing climate.

Building resilience through diversification will also help address other threats to sustainable use of marine resources, especially population growth and increasing fuel costs.

Two proven technologies are available immediately to help rural communities begin to diversify the ways they produce fish. These are low-cost inshore fish aggregating devices, FADs, (see Figure 6) and small-pond aquaculture.

The new regional project[1] will improve our understanding of the risks and identify additional methods of adaptation to help maintain the benefits of fisheries in the face of climate change.